

(NASA-CR-158595) SOLAR THERMAL POWER
GENERATION. A BIBLIOGRAPHY WITH ABSTRACTS
Quarterly Report, Apr. - Jun. 1977 (New
Mexico Univ.) 56 p

N79-76986

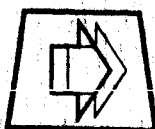
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Solar Thermal Power Generation

Quarterly Update April-June 1977



TECHNOLOGY APPLICATION CENTER
THE UNIVERSITY OF NEW MEXICO
ALBUQUERQUE, NEW MEXICO 87131



NASA

SOLAR THERMAL POWER GENERATION
A BIBLIOGRAPHY WITH ABSTRACTS

QUARTERLY UPDATE APRIL-JUNE 1977

PREPARED BY THE
ENERGY INFORMATION PROGRAM
of the
TECHNOLOGY APPLICATION CENTER

JULY 1977

THE UNIVERSITY OF NEW MEXICO
ALBUQUERQUE, NEW MEXICO

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INTRODUCTION

This is the second quarterly update of 1977 of Solar Thermal Power Generation.

In a continuing effort to compile the most current information from computerized data bases, the Technology Application Center has combined the efforts of its staff to produce this issue. The layout of this issue is slightly atypical, since many staff members had a hand in its publication. However, we trust the reader will find the breadth and depth of the information equal to the usual high standards of quality.

In this issue the most active areas are sections; 10,000 Energy Overviews, 16,000 Wind Conversion and 19,000 Other and Combined Systems. We are finding the developments in Wind Conversion to be of increasing interest.

We appreciate comment and suggestions the reader may have that would improve the utilization of the publication consequently resulting in a more reader responsive publication.

Geoffrey C. Bell
Technical Editor

Contributors:

Eugene Burch
Charles Fears
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GUIDE TO USE OF THIS PUBLICATION

A number of features have been incorporated to help the reader use this document. They consist of:

- A TABLE OF CONTENTS listing general categories of subject content and indexes. More specific coverage by subject title/keyword and author is available through the appropriate index.
- CITATION NUMBERS assigned to each reference. These numbers, with the prefix omitted, are used instead of page numbers to identify references in the various indexes. They are also used as TAC identifier numbers when dealing with document orders; so please use the entire (prefix included) citation number when corresponding with TAC regarding a reference. An open ended numbering system facilitates easy incorporation of subsequent updates into the organization of the material. In this system, numbers assigned to new citations in each category will follow directly the last assigned numbers in the previous publication. The citation number of the last reference on each page appears on the upper right-hand corner of that page to facilitate quick location of a specific term.
- A REFERENCE FORMAT containing the TAC citation number, title of reference, author, corporate affiliation, reference source, contract or grant number, abstract and keywords. The reference source tells, to the best of our knowledge, where the reference came from. If from a periodical, the reference source contains the periodical's title, volume number, page number and date. If for a report, the reference source contains the report number assigned by the issuing agency, number of pages and date.

--An INDEX OF AUTHORS alphabetized by author's last name. A reference's author is followed by the reference's citation number. For multiple authors, each author is listed in the index.

--An INDEX OF PERMUTED TITLES/KEYWORDS affords access through major words in the title and through an assigned set of keywords for each citation. A reference's title is followed by the reference's citation number. In the indexes, all the words pertaining to a reference are permuted alphabetically. Thus, the citation number for a reference appears as many times as there are major title words or keywords for that reference. The permuted words run down the center of an index page. The rest of the title or keywords appear adjacent to a permuted word. Since a title or set of keywords is allowed only one line per permuted word the beginning, the end, or both ends of a title or set of keywords may be cut off; or, if space permits, it will be continued at the opposite side of the page until it runs back into itself. A # indicates the end of a title or set of keywords while a / indicates where a title or set of keywords has been cut off within a line.

10,000 ENERGY OVERVIEWS

ST77 10045 OUR ENERGY FUTURE - THE ROLE OF RESEARCH, DEVELOPMENT, AND DEMONSTRATION IN REACHING A NATIONAL CONSENSUS ON ENERGY SUPPLY - BOOK

Kash, D.E., Devine, M.D., Freim, J.B., Gilliland, M.W., Rycroft, R.W., Wilbanks, T.J., (Oklahoma, University, Norman, OK), NSF SIA-74-17866, 511 p., 1976, University of Oklahoma Press, Research Supported by the National Science Foundation Norman, OK, A77-25224, \$19.95

The role of research, development, and demonstration (RD and D) in the energy supply system is examined and an investigation is conducted regarding the energy supply alternatives and RD and D needs. Solid fuels considered are related to coal, organic waste, and produce of energy farms. A description of gaseous and liquid fuels is presented, taking into account natural gas, gaseous fuel from oil, coal gasification, gaseous fuels from organic materials, domestic crude oil, coal liquefaction, oil shale, tar sands, and the liquefaction of organic materials. Approaches for obtaining energy in the form of electricity are discussed, giving attention to fossil fuels, organic materials, nuclear fission, nuclear fusion, geothermal power, hydroelectric power, solar electric power, and a comparison of electricity supply systems. Aspects of solar heating and cooling are discussed along with hydrogen energy systems.

(ALTERNATE SOURCES, OVERVIEW)

ST77 10046 OVERSIGHT HEARINGS; NEAR TERM ENERGY R AND D, 1976 ERDA PLAN AND PROGRAM, VOLUME 3

(Committee on Science and Technology, U.S. House), V 3:286, N60, 1976, Washington GPO Hearings Before Subcomm. on Energy Res., Development and Demonstration (Fossil Fuels) of Comm. on Sci. and Technol., 94th Congr., 2d Sess., Jan 26, 1976, N77-75714

Avail:Subcomm. on Energy Res., Development and Demonstration
No Abstract Available

ST77 10047 NATIONAL PLAN FOR ENERGY RESEARCH, DEVELOPMENT AND DEMONSTRATION CREATING ENERGY CHOICES FOR THE FUTURE. VOLUME 2 PROGRAM IMPLEMENTATION - FOSSIL FUELS, SOLAR ENERGY, AND GEOTHERMAL ENERGY

(ERDA, Washington, DC), ERDA-76-1-VOL-2, N77-19600

Avail:NTIS

The Federal Energy Research, Development, and Demonstration programs now underway are described along with possible future efforts. Financial data for FY 75, FY 76, and FY 77 are presented. Energy technology programs, supporting technology programs, energy-related supporting activities, special analyses, and an appendix are included. Fossil energy (coal, petroleum, and natural gas), solar energy, and geothermal energy, are discussed together with conservation, fusion power, fission power, and the nuclear fuel cycle.

(OVERVIEW, ALTERNATE SOURCES, CONSERVATION)

ST77 10048 STUDY OF MANPOWER REQUIREMENTS BY OCCUPATION FOR ALTERNATIVE TECHNOLOGIES IN THE ENERGY-RELATED INDUSTRIES, UNITED STATES, 1970 TO 1990, VOLUME 1

Gutmanis, I., Guiland, L.S., McBrayer, R.A., McKenna, R.P., Paul, A., (National Planning Association, Washington, DC), NSF-GR-32464, 260 p., Sponsored in part by the Dept. of Labor, FEA-C-03-50232-00, FEA/B-75/387-VOL-1, PB-243474/4, N77-70291

Avail:NTIS

No Abstract Available

ST77 10049 STUDY OF MANPOWER REQUIREMENTS BY OCCUPATION FOR ALTERNATIVE TECHNOLOGIES IN THE ENERGY-RELATED INDUSTRIES, UNITED STATES, 1970 TO 1990, VOLUME 3

Gutmanis, I., Guiland, L.S., McBrayer, R.A., McKenna, R.P., Paul, A., (National Planning Association, Washington, DC), NSF-GR-32464, 199 p., Sponsored in part by the Dept. of Labor, FEA-C-03-50232-00, FEA/B-75/390-VOL-3, PB-243477/7, N77-70279

Avail:NTIS

No Abstract Available

ST77 10050 ENERGY OPTIONS DURING THE NEXT TWENTY-FIVE YEARS. CONVENTIONAL FUELS, NUCLEAR POWER AND RENEWABLE ENERGY SOURCES

Pikul, R.P., Zraket, C.A., (MITRE Corp., Bedford, MA), 69 p., M74-32, N77-70475

Avail:NTIS

No Abstract Available

ST77 10051 ENERGY USE AND CLIMATE - POSSIBLE EFFECTS OF USING SOLAR ENERGY INSTEAD OF STORED ENERGY

Greeley, R.S., (MITRE Corp., Bedford, MA), 49 p., Sponsored by NSF, M74-66, N77-70479
 Avail:NTIS
 No Abstract Available

ST77 10052 STUDY OF MANPOWER REQUIREMENTS BY OCCUPATION FOR ALTERNATIVE TECHNOLOGIES IN THE ENERGY-RELATED INDUSTRIES, UNITED STATES, 1970 TO 1990. VOLUME 2, PART A

Gutmanis, I., Guiland, L.S., McBrayer, R.A., McKenna, R.P., Paul, A., (National Planning Association, Washington, DC), NSF-GR-32464, 201 p., Sponsored in part by the Dept. of Labor, FEA-C-03-50232-00, FEA/B-75/388-VOL-2-PT-A, PB-243475/1, N77-70280
 Avail:NTIS
 No Abstract Available

ST77 10053 ENERGY RESOURCES ALTERNATIVES COMPETITION - PROGRESS REPORT, FEB 1-DEC 31, 1975

Matzke, D.J., Osowski, D.M., Radtke, M.L., (Score, Inc., Cambridge, MA), 208 p., COO-2698-1, E(11-1)-2698, N77-19635
 Avail:NTIS

The objectives and results of the Intercollegiate Energy Resource Alternatives Competition are described. The goal of the competition was to design and build prototype hardware which provided space heating and cooling, hot water, and electricity at a level appropriate to the needs of homes, farms, and light industry. The hardware projects were powered by such non-conventional energy sources as solar energy, wind, biologically produced gas, coal, and ocean waves. The competition rules emphasized design innovation, economic feasibility, practicality, and marketability.

(ECONOMICS, RESIDENTIAL, ALTERNATE SOURCES)

ST77 10054 ENVIRONMENTAL TECHNOLOGY '76, INSTITUTE OF ENVIRONMENTAL SCIENCES ANNUAL TECHNICAL MEETING, 22ND, PROCEEDINGS

Anon, (Inst of Environ Sci, Mount Prospect, IL), Inst of Environ Sci Annu Tech Meet, 22nd, Proc, Philadelphia, PA, 564 p., Apr 26-28, 1976, Publ by Inst of Environ Sci, Mount Prospect, IL, 1976

The Proceedings contains 94 papers presented at the meeting. A wide range of subjects is covered, including pyrotechnic shock and shock testing, aerospace and environmental acoustics, fossil energy, solar energy, thermal simulation, contamination of spacecraft systems, life cycle environments technology, air pollution, water pollution, solid waste technology, and others.

(OVERVIEWS, ENVIRONMENT)

ST77-10055 ADDRESS BY HIS EXCELLENCY MINISTER LUBBERS ON THE OCCASION OF THE SILVER ANNIVERSARY MEETING OF THE EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS IN THE HAGUE, JUNE 1, 1976

Anon, Geophys Prospect, V 24:411-417, N3, Sept 1976

Activities of the International Energy Agency in the fields of fuel supply, energy conservation, hydrogen fuel, solar and geothermal energy, and systems analysis are reported. Coal technology, nuclear safety, wind and wave power, ocean thermal gradients, biomass conversion, and mining R&D advances are noted.

(CONSERVATION)

ST77 10056 ENERGY ALTERNATIVES: A COMPARATIVE ANALYSIS

Anon, (Univ of OK, Sci and Public Policy Program, Norman), Energy Alternatives: A Comp Anal Prep for Council on Environ Qual by Univ of OK, Sci and Public Policy Program, Norman, various pagings, 1975
 Avail:Supt of Doc, GPO, Washington, DC

This report provides descriptions and data on the major energy resource systems in the United States and suggests procedures for using these descriptions and data. The report is divided into two major parts. Part I (Chapters 1 through 13) contains descriptions of the coal, oil shale, crude oil, natural gas, tar sands, nuclear fission, nuclear fusion, geothermal, hydroelectric, organic wastes, and solar energy resource systems plus descriptions of electric power generation and energy consumption. In addition to discussing the resource and development technologies, each resource system description contains data on energy efficiencies, environmental residuals, and economic costs. Part II (Chapters 14 through 16) - describes procedures for using the descriptions and data contained in Part I in systematically evaluating and comparing the residuals, efficiencies, and economic costs of a proposed energy action and its alternatives.

(ECONOMICS, ENVIRONMENTAL IMPACT)

ST77 10057 ASHRAE TRANSACTIONS, PROCEEDINGS OF THE ASHRAE SEMI-ANNUAL MEETING, VOLUME 82, PART 1, 1976

Anon, (ASHRAE, New York, NY), ASHRAE Trans, V 82:1192, pt 1, 1976, Proc of the ASHRAE Semiannual Meet, Dallas, TX, Feb 1-5, 1976

Proceedings include 22 technical and 81 symposium papers. Technical papers contribute to the studies, field evaluation, experimental determination and measurement of various air conditioning, cooling, heating and refrigeration systems in buildings, laboratories and other facilities. Symposium papers cover the work, developments and innovations in the field of energy requirement, use and conservation concerning building heating and cooling; and instrumentation and testing machinery used for investigation of heating and cooling systems including systems solar energy utilization.

(CONSERVATION, HEATING & COOLING)

ST77 10058 ENVIRONMENTAL IMPACT OF ENERGY PRODUCTION: HEAT AND MASS TRANSFER PROBLEMS

Spalding, D.B., (Imp Coll of Sci & Technol, London, England), Int Semin on Future Energy Prod - Heat and Mass Transfer Probl, Dubrovnik, Yugoslavia, V 2:729-745, 34 refs, Aug 25-30, 1975, Publ by Hemisphere Publ Corp, Washington, DC, 1976

Redistribution and heat-transfer processes occurring when natural waters are "thermally polluted" are examined. Heat-transfer processes which occur within the atmosphere and chemical-pollution processes are implicitly treated by reason of the analogy between heat and mass transfer.

(POLLUTION)

ST77 10059 ENERGY - A RENEWED CHALLENGE TO ENGINEERS

Hawthorne, W., Energy Dig, V 5:4-9, N2, Apr 1976

This lecture reviews the world growth in energy consumption, the industrial and residential energy demand in 12 western European and North American countries, the national demand for energy sources (oil, natural gas, solid fuels, water power, and nuclear) in most of these same countries, estimations of the world demand and reserves of petroleum as of September 1973 and of January 1975, and estimates of economically recoverable worldwide coal reserves as of 1974. The problems of energy conservation are considered, including possible incentive and coercive approaches. Some reviewable energy resources are briefly discussed with emphasis on solar energy for heating.

(OVERVIEWS, CONSERVATION)

ST77 10060 ENERGY SOURCES FOR THE FUTURE AND THEIR EFFECTIVE UTILIZATION

Feld, B.T., (MIT, Cambridge, England), Aspects of Energy Convers, Proc of a Summer Sch, Lincoln Coll, Oxford, England, p. 313-320, July 14-25, 1975, Publ by Pergamon Press, Inc, Elmsford, NY, 1976

Replacement of oil by coal (used nonpollutingly), by hydropower and possibly by other simple but indirect forms of solar energy - wind, tidal - together with the provision of alternative fuels for use in transportation is discussed together with present fission power availability and use of geothermal energy. Hydrogen as energy carrier, nuclear fusion, and direct solar energy conversion are considered along with need for energy conservation.

(CONSERVATION, ALTERNATE SOURCES)

ST77 10061 ENVIRONMENT AND ENERGY PRODUCTION AFTER THE YEAR 2000

Gibrat, R., (SOLMER, France), Int Semin on Future Energy Prod - Heat and Mass Transfer Probl, Dubrovnik, Yugoslavia, V 1:27-42, Aug 25-30, 1975, Publ by Hemisphere Publ Corp, Washington, DC, 1976, See ST77-10025

Trends in nuclear economy are traced. Development of fast breeders and high temperature reactors, and possibilities of hydrogen fuel are reviewed. Secondary technologies, solar and geothermal energy, nuclear fusion and related environmental problems are discussed.

(ENVIRONMENTAL IMPACT, ALTERNATIVES)

ST77 10062 INFLUENCE OF ENERGY USE ON FUTURE INDUSTRIAL PROCESSES

Hadlow, M.E., Buss, B., (Electr Res Assoc, Surrey, England), Aspects of Energy Convers, Proc of a Summer Sch, Lincoln Coll, Oxford, England, p. 553-586, 19 refs, July 14-25, 1975, Publ by Pergamon Press, Inc, Elmsford, NY, 1976

Improvements in the effective utilization of energy in industrial production are suggested. Fields of energy R&D are mapped for various branches of industry, and fuel economy recommendations are made.

(CONSERVATION)

ST77 10063 ALTERNATE SOURCES OF ENERGY: A BIBLIOGRAPHY OF SOLAR, GEOTHERMAL, WIND, AND TIDAL ENERGY, AND ENVIRONMENTAL ARCHITECTURE

Harrah, B.K., Harrah, D.F., *Alternate Sources of Energy: A Bibliogr of Sol, Geotherm, Wind, and Tidal Energy, and Environ Archit*, 201 p., Publ by Scarecrow Press, Inc, Metuchen, NJ, 1975

This volume contains a bibliography composed of more than 1700 entries, mostly on solar energy. Included also are a number of sources dealing with wind, geothermal and tidal power. The listings are divided into six subject areas: Various unconventional sources of energy; solar energy; geothermal energy; wind energy; tidal energy; and environmental architecture (climate and energy).

(OVERVIEWS, ALTERNATE SOURCES)

ST77 10064 HEAT AND MASS TRANSFER PROBLEMS ASSOCIATED WITH ALTERNATIVE ENERGY PRODUCTION

Ramachandran, A., (Dep of Sci & Technol, New Delhi, India), *Int Semin on Future Energy Prod - Heat and Mass Transfer Probl*, Dubrovnik, Yugoslavia, V 2:639-651, 18 refs, Aug 25-30, 1975, Publ by Hemisphere Publ Corp, Washington, DC, 1976

Direct and indirect utilization of solar energy, ocean thermal gradients, photosynthetically created organic matter, and geothermal energy sources are reviewed with the aim of devising efficient generation methods. Hydrogenation, hydrogasification, pyrolysis, bioconversion, and energy production from organic wastes are considered.

(OVERVIEW, ALTERNATIVE POWER GENERATION)

ST77 10065 PERSPECTIVES FOR WORLD ENERGY PRODUCTION

Denton, J.C., (Am Technol Univ, Killeen, TX), *Int Semin on Future Energy Prod - Heat and Mass Transfer Probl*, Dubrovnik, Yugoslavia, V 1:13-26, 18 refs, Aug 25-30, 1975, Publ by Hemisphere Publ Corp, Washington, DC, 1976

A limited survey of the world's energy source forms is presented and the conclusion drawn is that energy resources are plentiful and equal to the task of fulfilling mankind's needs. The question then is one of the future energy production systems and their impacts on the earth's environment. The desirable features of future energy production systems are to (1) use high quality thermal energy sources, (2) use non-thermal energy driven conversion systems, and (3) preserve the quality of energy as much as possible during physical transport.

(ENVIRONMENTAL IMPACT, SURVEY)

ST77 10066 RENEWABLE ENERGY, SOCIETY AND THE ENVIRONMENT

MacDonald, R.G., (York Univ, Toronto, Ontario), p. 297-317, *Proc Ont Ind Waste Conf 23rd*, Toronto, Ontario, June 13-16, 1976

One energy technology which holds promise for alleviating both energy shortages and environmental problems and which is described in this paper, is that of renewable energy, solar energy, wind power and energy from biomass materials including organic wastes. Contrary to a widely held perception, renewable energy technology is essentially "in hand" and could be rapidly applied to our energy problems. Certain institutional barriers remain to be overcome. Industry has a critical role to play in the large-scale development and dissemination of this technology.

(ENVIRONMENTAL IMPACT, COMMERCIAL AVAILABILITY)

ST77 10067 ENERGY AND THE DEVELOPING COUNTRIES

Dunn, P.D., (Univ of Reading, England), *Aspects of Energy Convers*, *Proc of a Summer Sch*, Lincoln Coll, Oxford, England, p. 621-641, 9 refs, July 14-25, 1975, Publ by Pergamon Press, Inc, Elmsford, NY, 1976

Complementary role for the greater use of small scale, rural based, power plant used to assist development is explained. Solar energy utilization, and methane gas generation from waste are discussed.

(POWER PLANTS, METHANE PRODUCTION)

ST77 10068 FUTURE ENERGY PRODUCTION SYSTEMS: HEAT AND MASS TRANSFER PROCESSES, VOLUME 1 AND VOLUME 2

Denton, J.C., ed., Afgan, N.H., ed., (Am Technol Univ, Killeen, TX), *Int Semin on Future Energy Prod - Heat and Mass Transfer Probl*, Lect and Pap, Dubrovnik, Yugoslavia, V 2:866, Aug 25-30, 1975, Publ by Hemisphere Publ Corp, Washington, DC, 1976

Sixty-eight papers by various authors are presented. The topics discussed are: World energy production, environment, solar energy, mass transfer, heat storage, solar concentrators, evaporators, convection, nuclear power, hydrogen production, reactor cores, pressure drop, annular flow, boiling helium, steam generators, magnetohydrodynamic power systems, downflow, turbulent heat transfer, geothermal energy, aquifers, freon-operated power plants, coal gasification, combustion, pyrolysis, hydrogasification, fluidized beds, liquid lead heat exchange, alternative energy, production, laminar flow, ocean thermal power plant, environmental impacts of energy production, thermal impact of cooling water, energy storage in lakes, burners, and swirl flows.

ST77 10069 ENERGY CONSERVATION

Simmons, W.B., (St. Joe Pap Co, Port St. Joe, FL), TAPPI Alkaline Pulping Conf Prepr 1976: TAPPI Conf Pap - Alkaline Pulping and Test, for Meet, Dallas, TX, p. 281-284, Sept 13-15, 1976

Energy must be managed, just like any other industrial resource, if savings are to be achieved. Capital funds must be allocated with wisdom and insight to provide the energy-efficient systems and equipment that will be needed. This paper gives some details on the energy conservation program which has been introduced at St. Joe Paper Company (Florida) in 1969.

(ECONOMICS)

ST77 10070 ENERGY - THE INDUSTRY'S CHALLENGE AND OPPORTUNITY

Crisp, J.O., (Union Camp Corp, Franklin, VA), TAPPI Alkaline Pulping Conf Prepr 1976: TAPPI Conf Pap - Alkaline Pulping and Test, for Meet, Dallas, TX, p. 285-287, Sept 13-15, 1976

The industry is faced with a serious long-range energy problem. Fuel prices have increased at an unreasonable rate, while availability is uncertain. This paper provides a brief accounting of several projects in energy conservation actively being pursued at Union Camp's Franklin mill. The Union Camp mill at Franklin, Virginia is a typical bleached draft mill producing in excess of 1,600 tons per day of fine papers and coated board products. The average total power requirements for a ton of product are in the order of 1,000 kilowatt hours per ton. As a result of the energy conservation efforts the level of overall energy consumption in the mill has been cut by roughly 29%.

(CONSERVATION, ECONOMICS)

ST77 10071 ENERGY CONSUMPTION AND CONSERVATION IN THE UNITED STATES

Rothberg, J.E., (Univ of Washington, Seattle, WA), Aspects of Energy Conserv, Proc of a Summer Sch, Lincoln Coll, Oxford, England, p. 49-110, 36 refs, July 14-25, 1975, Publ by Pergamon Press, Inc, Elmsford, NY, 1976

Consumption patterns and end-uses which are the largest consumers of energy, and the impact of some conservation options with emphasis on conservation measures which can have some effect during the next 10 or 15 years are considered.

ST77 10072 DEMAND FOR NONFUEL MINERALS AND MATERIALS BY THE UNITED STATES ENERGY INDUSTRY, 1975-90

Albers, J.P., Sawiec, W.J., Rooney, L.P., US Geol Surv Prof Pap, 22 p., N1006-A, 39 refs, 1976

Estimates of nonfuel mineral raw-material requirements for modular units of fossil fuel, geothermal, hydroelectric, nuclear, and solar energy production in this report permit computation of total material requirements for other scenarios. Minimum estimates of nonfuel mineral raw-material requirements for all energy types 1975-90 indicate that concrete and iron are needed in the largest tonnages, but that substantial quantities of other materials such as aluminum, barite, bentonite, manganese, and nickel must also be available if the United States is to attain energy independence by 1990.

ST77 10073 GOVERNMENT BANKS ON PRIVATE SECTOR TO GAIN ENERGY INDEPENDENCE

Richardson, E., (US Dep of Commer, Washington, DC), Consult Eng, Barrington, IL, V 47:77-79, N4, Oct 1976

The Administration's goal, says the Secretary of Commerce, can be achieved with a minimum of regulation and maximum reliance upon the free market economy.

(ECONOMICS, NATIONAL POLICY)

ST77 10074 ENERGY PROGRAMS AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY

(Johns Hopkins Univ, Laurel, MD, Applied Physics Lab), 21 p., Sept 1976, APL/JHU-EQR/76-3, AD-A035 614/7WE

Results are reported on work in the following categories: status of geothermal energy in the states of South Dakota, New Hampshire, Florida, and Arkansas; initial nonnuclear energy development and utilization scenario development at APL; maritime aspects of OTEC plant-ships; and a Community Annual Storage Energy System (CASES).

ST77 10075 AN APPRAISAL OF ELECTRICAL ENERGY ALTERNATIVES AVAILABLE TO THE STATE OF NEW YORK

Becker, M., Wicks, F., Verazunis, S., (Rensselaer Polytechnic Inst., Troy, NY, Center for Technology Assessment), 210 p., Oct 1976, RPI-TA-14, NYSERDA-75/21, PB-262 373/9WE

The development and application of a model for the appraisal of electrical energy alternatives available to the State of New York is described. Prior work related to the acquisition of a data base representative of the current and future systems for electric power generation is summarized. The implications of new studies in the areas of wind turbines as a mode of generation, solid wastes as an alternative fuel, and solar energy for residential heating and passive energy conservation to electrical energy generation in New York State are evaluated. A calculational system that permits the appraisal of a broad range of scenarios in a consistent manner is developed.

(COMPARATIVE ANALYSIS)

ST77 10076 PRESENT AND NEAR-FUTURE DEMAND FOR ENERGY IN THE UNITED STATES

Sailor, V.L., (Brookhaven National Lab., Upton, NY), 23 p., Apr 8, 1976, CONF-760479-1, BNL-21236

The hazards of forecasting and the limitations for analysis are discussed. Historical trends in energy consumption, the correlation between energy consumption and economic welfare, and a driving force for change based on convenience, technological versatility, and economics are discussed in a section prior to energy demand projections. At BNL, 25 to 30 consuming scenarios have been projected in the following sectors: residential, commercial, industry, electric generation, and transportation. An example is followed involving residential space heating for 3 fuel types. The final section of the paper examines the impact of price increases and conservation. It is concluded that if adequate supplies of energy are not available at tolerable prices, consumption levels will adjust to balance demand against supply. It is critical to the economic future that this balancing process be achieved in an organized and rational manner, rather than blundering into a situation where the forces of fuel economics solves the problem.

(OVERVIEW, CONSERVATION, ECONOMICS)

ST77 10077 ENERGY TECHNOLOGY ASSESSMENT: CONSIDERATIONS OF GEOGRAPHICAL SCALE

Palmado, P.F., (Brookhaven National Lab., Upton, NY), 20 p., May 13, 1976, CONF-760573-1, BNL-21663

Energy technology assessment is the systematic evaluation of the implications of alternative technological means to fulfill society's need for energy. Among the implications that are of concern are economic and environmental impacts, requirements for physical and institutional infrastructure, and required investments, for example, in research and development. Assessment generally assumes, implicitly or explicitly, a decision to be made. Both the set of implications considered by the analysis and the decisions to be affected by it have characteristic geographical scales. For impacts, the scale is determined by such things as the range of pollutant transport which, in turn, is affected by physical geography. The geographic scale of decisions is determined almost completely by political jurisdictions. This paper discusses some of the implications of the differences between those scales and suggests an important role for energy technology assessment in mediating between them. The geographical morphology of energy technology assessment, particularly as that assessment applies to public policy decisions, is of concern here. The particular decisions that are dealt with are those that can have a significant effect on the set of technologies used by a country or in a region of a country in the future. Some examples are the determination of a national research and development policy, the setting of air pollutant emission standards for power plants, or the adoption of major energy pricing policies.

(ECONOMICS, ENVIRONMENTAL IMPACT)

11,000 SOLAR OVERVIEWS

ST77 11044 FEASIBILITY OF MEETING THE ENERGY NEEDS OF ARMY BASES WITH SELF-GENERATED FUELS DERIVED FROM SOLAR ENERGY PLANTATIONS Final Report

Szego, G.C., (Intertechnology Corp., Warrenton, VA), 161 p., ARPA Order 2630, DACA23-74-C-0009, ITC-260675, AD-A031163, N77-19662
 Avail:NTIS

This project thoroughly investigated the possibility of collecting and storing solar radiation in plants especially grown for their fuel value as a source of fuel on U.S. army bases. The study investigated the merit of producing this fuel at energy plantations at or near the bases. The fuel would be used for directly fired steam generators, hot water heaters, space heaters, and cooking. The research examined the major characteristics of energy plantations; analyzed plant-matter production rates from deciduous plants; and examined fuel consumption in stationary facilities at major troop training centers. The possibilities and requirements of energy plantations at Fort Benning, Fort Leonard Wood, and at army bases in general were detailed. It was concluded that energy plantations could be feasible at approximately 15 large

army bases and that the cost of solid fuel produced from them would be approximately \$1/1 million Btu; the cost of synthetic natural gas produced from plants was determined to be approximately \$3.10 to \$4.20/1000 standard cu ft. Besides being a perpetually renewable fuel source, it was found that energy plantations could provide independence from other fuel sources, reduction in future environmental problems caused by present fuels, and will productively use land not now in active use.

(ECONOMICS, FUEL PRODUCING)

ST77 11043 FEASIBILITY OF MEETING THE ENERGY NEEDS OF ARMY BASES WITH SELF-GENERATED FUELS
DERIVED FROM SOLAR ENERGY PLANTATIONS. Appendixes A, B, and C Final Report

Szego, G.C., (Intertechnology Corp., Warrenton, VA), 325 p., ARPA Order 2630, DACA23-74-C-0009, ITC-260675-APP-A, ITC-260675-APP-B, ITC-260675-APP-C, AD-A031164, N77-19663
Avail:NTIS
No Abstract Available

ST77 11046 FIELD INVESTIGATIONS OF SOLAR ENERGY CONVERTERS

Iosifyan, A.G., Fialkov, A.S., Davidovich, Y.G., Kuchinskaya, O.F., Petrosyan, L.S., Zaychikov, S.G., Lysenko, T.V., (Air Force Systems Command, Wright-Patterson AFB, OH), 16 p., Trans. Into English from Vestn. Elektropromyshlennosti, USSR, p. 38-43, N7, 1960, FID-TT-61-56/1+2, AD-270794, N77-73985
Avail:NTIS
No Abstract Available

ST77 11047 ENVIRONMENTAL TECHNOLOGY '76; PROCEEDINGS OF THE TWENTY-SECOND ANNUAL TECHNICAL MEETING, PHILADELPHIA, PA, APRIL 26-28, 1976

(Mount Prospect, IL, Institute of Environmental Sciences), 583 p., 1976, For Individual Items See A77-26028 to A77-26072, A77-26027, PCS22.00

Attention is given to pyrotechnic shock testing, dynamics digital control, vibration testing, aerospace acoustics, environmental acoustics, fossil-fuel energy, nuclear contamination control and testing, and seismic testing. Also considered are thermal vacuum spacecraft and system testing, thermal simulation, spacecraft contamination, solar energy, and climatics. Instrumentation and reliability, air pollution, water pollution, and solid waste technology are also considered.

(OVERVIEW, ENVIRONMENTAL POLLUTION, FOSSIL FUELS)

ST77 11048 REVIEW - SILICON SOLAR CELLS FOR TERRESTRIAL APPLICATIONS

Rouse, L.M., (Materials and Energy Research Centre, Teheran, Iran), Journal of Materials Science, V 12:602-615, Mar 1977, A77-25085

Advances made in the design and fabrication of high-efficiency solar cells, particularly silicon diffused junctions, are reviewed along with the economics of their application outside the U.S.A. The discussion covers the efficiency of a homojunction device, physical factors which determine the efficiencies of homojunction solar cell, substrate fabrication, junction fabrication techniques, and silicon Schottky barriers. Ways in which solar cell utilization can be made more economical are identified.

(OVERVIEW, DESIGN-FABRICATION, ECONOMICS)

ST77 11049 A PRELIMINARY ASSESSMENT OF SOLAR ENERGY TECHNOLOGY

Garg, D.P., (Duke University, Durham, NC), ASME Paper 76-WA/TS-1, 10 p., 1976, American Society of Mechanical Engineers, Winter Annual Meeting, New York, NY, Dec 5-10, 1976, A77-26531, Members \$1.50, Nonmembers \$3.00
See ST77-11016

ST77 11050 SOLAR ENERGY. THE ALTERNATE OPTION. GEOTHERMAL ENERGY - THE NEGLECTED OPTION

Ouellette, R.P., (MITRE Corp., Washington, DC), 43 p., Presented at the Japanese Industrial Planning Assoc., Tokyo, Japan, Sept 17-19, 1973, M73-219, N77-70463
No Abstract Available

ST77 11051 LARGE-SCALE UTILIZATION OF SOLAR ENERGY

Haas, G.M., (MITRE Corp., McLean, VA), 40 p., Presented at Symp. on Energy Resources and the Environment, Kyoto, Japan, July 11, 1972, M72-168, N77-70071
No Abstract Available

ST77 11052 THE ROLE OF AND NEED FOR TECHNOLOGY IN OUR SOCIETY

Teller, E., (MITRE Corp., Washington, DC), 20 p., M74-4, N77-70475
Avail:NTIS
No Abstract Available

ST77 11053 UTILIZATION OF SOLAR ENERGY IN SWITZERLAND; PRESENT-DAY POSSIBILITIES AND LIMITATIONS

Elmiger, E., (Nordostschweiz Kraftwerke, Baden, Switzerland), Bull Assoc Suisse Electr, V 67: 221-224, N5, Mar 6, 1976, In German

The maximum density of solar irradiation in the Swiss Plateau is approximately 900 w. This considerably high radiation level has only limited utilization. At most it can be used for heating swimming pools and for the preparation of hot water in summer or perhaps even for space heating in combination with a heating pump. The advantages and disadvantages of using solar energy are discussed. Additional developments for practical implementation are considered.

(FEASIBILITY STUDY)

ST77 11054 SOLAR ENERGY

Brinkworth, B.J., (Univ Coll, Cardiff, Wales), Aspects of Energy Convers, Proc of a Summer Sch, Lincoln Coll, Oxford, England, p. 431-448, 7 refs, July 14-25, 1975, Publ by Pergamon Press, Inc, Elmsford, NY, 1976

Possibilities of direct use of radiation are explored by improved collector design, space-heating systems, and thermodynamic conversion. Photochemical and photobiological processes are investigated, and thermionic and thermoelectric generators are discussed.

(THERMIONIC, THERMODYNAMIC CONVERSION)

ST77 11055 NET ENERGY DELIVERY FROM GEOTHERMAL RESOURCES

Bowen, R.G., (Arizona Geothermal Energy Conference, Phoenix, AZ, Nov 21-23, 1976), Geothermal Energy, V 5:15-19, Feb 1977, A77-25137

The efficiency of geothermal power systems is compared to that of other systems with emphasis on concepts of 'net energy' (useful energy output from system less useful energy input - 'useful' referring to ready marketability of the energy form) and overall system efficiency (as contrasted to power plant efficiency in isolation). External energy inputs required to convert energy to the desired form in the system are figured into the efficiency calculations, and input needed for prospecting/exploration/extraction (well drilling, well completions, replacement of wells) is taken into account, as well as energy input to reservoir development and maintenance. In this context, the low geothermal plant energy conversion efficiency is offset by high system efficiency; chart comparisons are presented with nuclear fission (LWR) plants, coal-fired power plants at mine mouth), and solar home heating units.

(COMPARATIVE ANALYSIS, POWER GENERATION)

ST77 11056 SOLAR ENERGY RESEARCH INSTITUTE; OVERSIGHT HEARINGS

(Committee on Science and Technology, U.S. House), Washington GPO Hearing Before Subcomm. on Energy Res., Development and Demonstration of Comm. on Sci. and Technol., 94th Congr., 1st Sess., 412 p., N46, Oct 22, 1975, GPO-65-506, N77-75713
Avail:Subcomm. on Energy Res., Development and Demonstration
No Abstract Available

ST77 11057 COMPREHENSIVE STANDARDS - THE POWER GENERATION CASE

Pigford, T.H., Keaton, M.J., Mann, B.J., Sessler, G.L., (Teknekron, Inc., Berkeley, CA), 360 p., TEKNEKRON/EEED-104, TEKNEKRON/EEED-105, EPA-68-01-0561, PB-259876/1, N77-75772
Avail:NTIS
See ST77-10035

ST77 11058 DEVELOPMENTS IN SOLAR ENERGY UTILIZATION IN THE UNITED KINGDOM

McVeigh, J.C., (Brighton Polytechnic, England), 17 p., Presented at the Annual Meeting of the Intern. Solar Energy Soc., Los Angeles, CA, July 28, 1975, CONF-750712-10, N77-73348
Avail:NTIS
See ST77-11031

ST77 11059 SOLAR TOTAL ENERGY PROGRAM SEMIANNUAL REPORT, APR-SEPT 1975

Champion, R.L., ed., Edenburn, M.W., ed., (Sandia Labs., Albuquerque, NM), 99 p., AT(29-1)-789, SAND-76-0073, N77-74237

Avail:NTIS

See ST-11010

ST77 11060 COMPARATIVE ANALYSIS OF THE 1976 ERDA PLAN AND PROGRAM

(Office of Technology Assessment, Washington, DC), 213 p., OTA-E-28, PB-254794/1, N77-72603

Avail:NTIS

See ST77-10000

ST77 11061 JAPANESE/UNITED STATES SYMPOSIUM ON SOLAR ENERGY SYSTEMS. VOLUME 1 - SUMMARY OF PROCEEDINGS

(MITRE Corp., McLean, VA), NSF GI-44066, 32 p., Held at Washington, DC, June 3-5, 1974, MTR-6739-VOL-1, N77-70594

Avail:NTIS

No Abstract Available

ST77 11062 JAPANESE/UNITED STATES SYMPOSIUM ON SOLAR ENERGY SYSTEMS. VOLUME 2 - SUMMARIES OF TECHNICAL PRESENTATIONS

(MITRE Corp., McLean, VA), NSF GI-44066, 147 p., Held at Washington, DC, June 3-5, 1974, MTR-6739-VOL-2, N77-70595

Avail:NTIS

No Abstract Available

ST77 11063 UTILIZATION OF SOLAR AND WIND ENERGY TO IMPROVE THE LIVING ENVIRONMENT IN LESS DEVELOPED COUNTRIES

Ramakumar, R., (Oklahoma State Univ, Stillwater, OK), Inst of Environ Sci Annu Tech Meet, 22nd, Proc: Environ Technol '76, Philadelphia, PA, p. 314-318, 16 refs, Apr 26-28, 1976, Publ by Inst of Environ Sci, Mount Prospect, IL, 1976

Availability of small-scale energy systems in remote rural communities in less developed countries can provide the basic needs of life and considerably improve the living environment for millions of people. The paper discusses the prospects of utilizing renewable energy sources such as solar and wind energy to achieve this goal and presents a systematic approach to develop viable rural economic units in such countries.

(RURAL DEVELOPMENT)

ST77 11064 SOLAR ENERGY IN SWITZERLAND

Mueller, R.E., (Off Fed de l'Econ Energy, Berne, Switzerland), Bull Assoc Suisse Electr, V 67: 216-221, N5, 18 refs, Mar 6, 1976, In French

Research and development activities in Switzerland associated with the utilization of solar energy are reviewed, particularly as they concern the generation of heat. Modern projects for the generation of mechanical and electric energy are discussed, along with the construction of "sun houses."

(POWER GENERATION, HEATING, RESIDENTIAL)

ST77 11065 DESIGN FOR AN ALTERNATIVE TECHNOLOGY

Liddell, H.L., (Hull Sch of Archit, England), Aspects of Energy Convers, Proc of a Summer Sch, Lincoln Coll, Oxford, England, p. 827-830, 10 refs, July 14-25, 1975, Publ by Pergamon Press, Inc, Elmsford, NY, 1976

The case of no-growth in nuclear power generation is argued. More solar energy research is advocated together with a "soft" technology orientation of society.

(POLICY OPTIONS)

ST77 11066 PROCEEDINGS OF FIRST SEMIANNUAL EPRI SOLAR PROGRAM REVIEW MEETING AND WORKSHOP HELD IN SAN DIEGO, CALIFORNIA, ON MARCH 8-12, 1976. VOLUME II: SOLAR ELECTRIC POWER

30s, P., (Atlas Corporation, Santa Clara, CA), 239 p., Mar 12, 1976, EPRI/ER-283-SR-Vol-2, PB-260 595/4WE

Contents: Environmental assessment of solar energy power plants; Requirements definition and impact analysis of solar thermal power plants; Closed cycle, high temperature central receiver concept for solar electric power; Open cycle gas turbine solar electric system; Preliminary system analysis of a solar power central station; A study of the impact on margin requirements for utility systems of large-scale utilization of solar power plants; Requirements assessment of photovoltaic electric power systems; Thermophotovoltaic project.

(OVERVIEW, ENVIRONMENTAL IMPACT)

ST77 11067 A FEDERAL PROCUREMENT PLAN TO ACCELERATE USE OF SOLAR ENERGY

(Don Sowle Associates, Inc., Arlington, VA), 100 p., Dec 1976, FEA/G-77/044, PB-263 369/1WE

The Solar Energy Government Buildings Program (SEGBP) is a major commercialization project being developed by the Federal Energy Administration in conjunction with other agencies. This project will use a portion of the vast inventory of Federal buildings to provide an early and significant market for solar heating and hot water equipment and thus assist the early development of a solar heating and cooling industry infrastructure. This report addresses key features of Government procurement as part of an overall implementation plan for the SEGBP. The report reviews trends and techniques in Government procurement, discusses alternative strategies, and sets forth a procurement plan to achieve SEGBP goals and objectives.

(COMMERCIAL OFFICE BUILDING, HEATING AND COOLING)

ST77 11068 SOLAR ENERGY, DFVLR ACTIVITIES

(Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Braunschweig, Germany, F.R.), 8 p., Feb 11, 1976, ERDA-tr-143, Translation of German report

The research programs of the DFVLR in the area of utilization of solar energy are briefly summarized in terms of systems with focusing collectors, systems with flat collectors, and wind turbines.

(FEDERAL REPUBLIC OF GERMANY)

ST77 11069 PROSPECTS FOR TERRESTRIAL USE OF SOLAR ENERGY

Gray, J., (AIAA, New York, NY), Trab Apresentados a Conv da UPADI, 14th, Rio de Janeiro, Brazil, Oct 3-8, 1976, Publ by Fed Bras de Assoc de Eng, Brazil, V 3:225-300, 49 refs, 1976

The paper addresses the following classes of solar-powered systems capable of generating energy for terrestrial consumption: solar heating and cooling using energy collectors; solar-thermal electric power conversion; photovoltaic conversion of solar radiation directly to electric power; synchronous satellite solar power - i.e., power transmitted to Earth from a photovoltaic solar array in geosynchronous orbit; ocean thermal energy conversion based on temperature difference between the warm surface and cold deep water layers; use of biomass energy - i.e., stored chemical energy created by photosynthesis in vegetation; and wind power.

(OVERVIEWS, POWER GENERATION, CONVERSION, ALTERNATE SOURCES)

ST77 11070 SOLAR REALITIES

3os, P.B., (EPRI, Solar Energy Program, Palo Alto, CA), EPRI J, V 1:6-13, N1, Feb 1976

The contributions solar energy can make in heating, cooling, and electricity generation are discussed and the technical and economic impediments to significant solar applications in the near future are examined.

(HEATING AND COOLING, ELECTRICAL GENERATION)

12,000 ECONOMICS AND LAW

ST77 12025 ECONOMIC COMPETITIVENESS OF SOLAR-ENERGY WITH CONVENTIONAL FUELS AND ELECTRICITY

Saifulrehamn, M., (Pakistan Council Sci & Ind, Res Labs, Solar Energy Grp, Lahore 16, Pakistan), Solar Energy, V 18:577-579, N6, 8 refs, 1976

No Abstract Available

ST77 12026 THE EFFECTIVENESS OF SOLAR ENERGY INCENTIVES AT THE STATE AND LOCAL LEVEL

(Booz-Allen and Hamilton, Inc., Washington, DC), 95 p., Mar 1976, FEA/G-77/046, PB-263 371/TWE

The Federal Energy Administration (FEA) is currently developing policies and programs to accelerate the utilization and widespread commercialization of solar energy technologies. As part of this program, FEA contracted this study to provide an overview of existing, proposed and possible state and local actions to encourage or stimulate the use of solar energy heating and cooling systems. This report is directed primarily to state and local legislatures and administrations and has two principal objectives: (1) To explore the state and local issues

surrounding widespread solar energy development, and (2) To indicate areas for assessment and evaluation, both in the design of state and local incentive programs and in the development of Federal support of those efforts.

(STATE-FEDERAL POLICIES)

ST77 12027 EXPERIENCE WITH PARAMETER IDENTIFICATION FOR SOCIOECONOMIC MODELS

Brewer, J.W., Mitchiner, J.L., Young, J.W., (California Univ., Davis, CA), 19 p., 1976, CONF-760713-1, SAND-76-5651

In this paper, the authors describe their experiences in parameter identification for forecasting models. These models include descriptions of urbanization of a naturally scenic area, demand for natural gas in California, and the long-term use of land and energy in the United States. The technique that is emphasized is the "delta approximation" method invented by the authors. In this method, statistical inference is abandoned in favor of providing a method that can be used with large complex models. The success of the method is illustrated with several examples.

ST77 12028 SOLAR SYSTEMS MARKET GROWS. . . AND GROWS

Wood, A.S., Mod Plast, V 53:42-44, N12, Dec 1976

This paper reports on recent developments in the use of plastics in design of solar heating and cooling equipment. Now plastics are playing key roles in the development of an increasing number of economical and efficient industrial systems, some of them involving temperatures in excess of 1000°F. And, as a sure sign of continued growth, new resin types are getting into the act as the installations curve climbs steadily. The review report is presented under headings - plastics for the hot jobs; many different collector approaches; new materials getting into the act; new direction in thermal insulation; and market size considerations.

(PLASTICS INDUSTRY, HEATING)

ST77 12029 BUYING SOLAR

Dawson, J., (Department of Health, Education and Welfare, Washington, DC), 81 p., June 1976, Office of Consumer Affairs, FEA/G-76/154, PB-262 134/OWE

This book offers guidelines for the consumer interested in buying solar systems. It should help the homeowner considering the use of solar energy for space heating and cooling and domestic water heating to make informed decisions based on geographic location, type of home, quality of insulation, present energy costs, and type of solar system intended for purchase. It includes engineering terms used to evaluate or describe solar products.

(CONSUMER GUIDE, HEATING, COOLING, ECONOMICS)

ST77 12030 PROJECTING AN ENERGY-EFFICIENT CALIFORNIA

Goldstein, D.B., Rosenfeld, A.H., (California Univ., Berkeley, CA, Lawrence Berkeley Lab), 45 p., Dec 24, 1975, LBL-3274

The effects on California electricity consumption of a postulated program of mandatory energy conservation standards for building construction and for appliances are calculated. The model sums demands disaggregated by end use in the residential and commercial sectors; for industry a simplified econometric model is used. The potential for growth and conservation is evaluated for each end use, subject to the constraint that only conservation standards resulting in a cost savings to consumers are included. Using assumptions of fairly high demand for energy-using devices, it is projected that, with this program of mandatory energy conservation standards, California electricity use will grow by about 12 percent over the ten years from 1974 to 1984; (from 133 billion kWh in 1974 to 171 billion after ten years).

(CONSERVATION PROGRAM, ECONOMETRIC MODEL)

ST77 12031 SOLAR ENERGY - HOW ECONOMIC IS ITS USE?

Weyss, N., Gros, J., (Int Inst fuer Angew Systemanal, Laxenburg, Austria), Destarr & Elektr, V 29:406-414, N10, 9 refs, Oct 1976, In German

Assuming a hybrid power plant operated by fossil fuel (when solar energy is not available) or by solar energy (when solar insolation is adequate), it is possible, with emphasis on relatively few key parameters, to construct a simplified methodology that permits economic feasibility evaluation of solar energy augmented power plants. An easy to use graphical computation aid is developed for this methodology, and is illustrated in four typical sample cases.

(POWER-PLANT, SYSTEM-REVIEW)

13,000 THERMAL POWER

ST77 13041 SIMULATION AND OPERATION OF A SOLAR POWERED ORGANIC RANKINE CYCLE TURBINE

Veneruso, A.F., (Sandia Laboratories, Albuquerque, NM), ASME Paper 76-WA/SOL-18, 15 p., 1976, American Society of Mechanical Engineers, Winter Annual Meeting, New York, NY, Dec 5-10, 1976, ERDA-Supported Research, A77-26523, Members \$1.50, Nonmembers \$3.00

Sandia Laboratories' ERDA-sponsored Solar Total Energy System test facility utilizes 814 sq m (8759 sq ft) of solar tracking, east-west oriented, parabolic trough collectors to heat therminol 66 heat transfer fluid to 316°C (600°F). The energy is stored as sensible heat in a 5246 gal storage tank. The solar-heated fluid is then used to power an organic Rankine cycle turbine supplied by Sundstrand Aviation of Rockford, Illinois. This turbine supplies 32 kW of electricity as well as providing, through its condenser output loop, space heating and cooling with an absorption air conditioner. This test system with programmable inputs and loads, comprises a flexible experimental tool for evaluating components and sub-systems. The simulation procedure consists of mathematically modeling the turbine components, heat exchangers, solar-heated fluid loops, and controls. The results of digital computer simulation of this system are given along with experimental performance data on the integrated solar turbine system.

(MATHEMATICAL MODEL)

ST77 13042 SOLAR THERMAL ELECTRIC POWER SYSTEMS - MANUFACTURING COST ESTIMATION AND SYSTEMS OPTIMIZATION

Duff, W.S., Shaner, W.W., (Colorado State University, Fort Collins, CO), ASME Paper 76-WA/HT-14, 10 p., 1976, American Society of Mechanical Engineers, Winter Annual Meeting, New York, NY, Dec 5-10, 1976, NSF-ERDA-Supported Research, A77-26474, Members \$1.50, Nonmembers \$3.00

The design of a 100 megawatt solar thermal electric power (STEP) plant is considered. In the case of a system operating with 19% efficiency, such a plant would require an area approximately one mile on each side. The cost of the energy provided is on the order of 4.0 cents per kilowatt-hour. Such a cost appears to be competitive if it is compared with the cost of energy provided by conventional peaking plants. Such a comparison appears justified because peak sunshine occurs at approximately the same time as peak electrical demand. The most important disadvantage of the STEP plant is the fact that sunshine is unreliable. Attention is given to different types of STEP systems, a component cost breakdown, aspects of systems optimization, and a collector manufacturing cost estimation.

(ECONOMICS)

ST77 13043 CENTRAL RECEIVER SOLAR THERMAL POWER SYSTEM. COLLECTOR SUBSYSTEM RESEARCH EXPERIMENTS QUARTERLY TECHNICAL PROGRESS REPORT, JAN 2-MAR 31, 1976

(Boeing Co., Engineering and Construction Div., Seattle, WA), 92 p., SAN-1111-76-2, D277-10025-1 QTPR-2, E(04-3)-1111, Also see ST77-13000, N77-19649
Avail:NTIS

A description of the detail design (DD) of research experiment hardware to support the 10 MW/sub E/ pilot plant preliminary design (PD) is presented. Additionally, test plans for assembly, integration, and array tests are summarized along with results of completed component/material tests. Research experiment DD and tests described herein were planned to provide design verification and supporting data, with hardware which either duplicates, or closely simulates the pilot plant PD baseline.

ST77 13044 SUMMARY OF RECENT DEVELOPMENTS IN SMALL RANKINE CYCLE POWER SYSTEMS

Hoagland, L.C., (CTI-Cryog, Waltham, MA), Intersoc Energy Convers Eng Conf, 11th, Proc, State Line, NV, Sept 12-17, 1976, Publ by AIChE, New York, NY, V 2:1146-1147, 1976

Use of organic Rankine cycle engines for solar energy utilization, particularly for space heating and cooling systems, heat pumps and air-conditioners is discussed.

(HEATING AND COOLING, HEAT PUMPS)

ST77 13045 SOLAR TOTAL ENERGY CONTROL DATA ACQUISITION SYSTEM

Shurtleff, W.W., (Sandia Labs., Albuquerque, NM), 32 p., Nov 1976, SAND-76-0506, Not available NTIS
Avail:ERDA, P.O. Box 62, Oak Ridge, TN 37830, Attn:TIC

This report describes the control-data acquisition system for Sandia's Solar Total Energy facility. The system is versatile and easily used. It handles multiple tasks simultaneously

ST77 13046 SOLAR CENTRAL ELECTRIC-POWER GENERATION A BASELINE DESIGN

Powell, J.C., (Honeywell Inc, Syst & Res Ctr, Minneapolis, MN; Black & Veatch Consulting Engrs, Kansas City, MO), IEEE Transactions on Power Apparatus and Systems, V 94:1924, N6, 1975
No Abstract Available

ST77 13047 POTENTIAL OF A SOLAR COLLECTOR WITH A STATIONARY SPHERICAL REFLECTOR AND A TRACKING ABSORBER FOR ELECTRICAL POWER PRODUCTION

Clausing, A.M., (Sandia Labs., Livermore, CA), 48 p., Aug 1976, SAND-76-3039

A fixed segment of a concave spherical mirror can be used to concentrate beam radiation onto a tracking absorber which pivots about the center of curvature of the mirror. A possible economic advantage of this system over concentrating collectors with tracking mirrors is reduced mirror cost. The characteristics of this system are analytically studied. The strong influences of the geometrical parameters of the stationary reflector/tracking absorber system are established. The penalty caused by the fixed reflector and the influence of the absorber temperature is also determined. The daily and yearly variations in the power produced by the system are presented.

(ECONOMICS, COMPARATIVE ANALYSIS)

ST77 13048 OPTIMAL OVERALL EFFICIENCY FOR A SOLAR RADIATION COLLECTOR UTILIZING A TWO FLUID RANKINE CYCLE TO GENERATE ELECTRICAL POWER

Cobble, M.H., Smith, P.R., (New Mexico State Univ, Las Cruces, NM), Inst of Environ Sci Annu Tech Meet, 22nd, Proc: Environ Technol '76, Philadelphia, PA, p. 308-313, Apr 26-28, 1976, Publ by Inst of Environ Sci, Mount Prospect, IL, 1976

Equations for concentration, mirror efficiency, and collector efficiency are developed and solved numerically for an absorber tube, enclosed by a partially silvered glass envelope, placed at the focus of a parabolic mirror. Utilizing a thermal storage boiler, and expression for the overall efficiency of a system using the collector, the thermal storage boiler, and a two fluid Rankine Cycle to generate electrical power is derived and solved numerically to determine the optimum operating condition for this system.

(MATHEMATICAL SIMULATION)

ST77 13049 ENERGY STORAGE: USER NEEDS AND TECHNOLOGY APPLICATIONS

Anon, (ERDA, Tech Inf Cent, Oak Ridge, TN), Energy Storage: User Needs and Technol Appl, Eng Found Conf, Exec Summ, Asilomar, Pacific Grove, CA, 52 p., Feb 8-13, 1976, Publ by ERDA, Tech Inf Cent, Oak Ridge, TN, 1976, CONF-760212
Avail:NTIS

This document contains highlight summaries of the presentations and panel discussions at the conference Energy Storage - User Needs and Technology Applications sponsored by the Engineering Foundation and held at Asilomar, California, on Feb. 8-13, 1976. The document is based on material prepared at the conference and has been updated by comments from the authors. Among discussions presented are utility problems and needs for energy storage, dispersed energy storage credit, role of government and financial institutions, thermal energy storage, solar electric utility storage, and transportation and energy storage.

(CONFERENCE REPORT, CONVERSION)

ST77 13050 SOLAR PILOT PLANT, PHASE I. QUARTERLY REPORT NO. 2, JANUARY-MARCH 1976

(Honeywell, Inc., Minneapolis, MN), 100 p., Aug 20, 1976, Energy Resources Center, SAN/1109-76/2

During the report period, conceptual designs for the collector and steam generator subsystem research experiments (SREs) were approved, and design detailing began. The thermal storage SRE concept was modified through additional analyses and engineering model experiments and resubmitted for evaluation. Detailed designs for all three subsystems will be submitted during the next quarter. Preparation for SRE testing proceeded through procurement of long-leadtime items and detailed definition of test arrangements. Analysis and design of the electrical generation subsystem and balance of the plant proceeded essentially on schedule.

(SUBSYSTEM RESEARCH EXPERIMENT, ELECTRICAL GENERATION)

ST77 13051 CENTRAL RECEIVER SOLAR THERMAL POWER SYSTEM, PHASE I. QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1976

(Martin Marietta Corp., Denver, CO), 128 p., July 1976, SAN/1110-76/T2

The major program activities were aimed toward the fabrication of the three major research experiments and continued evaluation of the pilot plant performance and operating modes. The detail designs were completed early in this period. Effort was continued in the evaluation of pilot plant start transients. Both warm and hot starts from thermal storage were evaluated as was a cold start from the receiver. In the collector subsystem experiment the heliostat

structures and drive mechanisms were completed and delivered. The sensor and associated electronics for the first heliostat were completed as were installation and checkout of the PDP-11 computer and control console for the entire collector experiment. By the end of May the first twenty-five mirror heliostat had been erected and was operational. The detail design of the 5 MW receiver experiment was completed at Foster Wheeler. In the thermal storage subsystem the detail design of the experiment was completed early in the period. A final selection of the heat transport media was made with Hitec selected as the molten salt and Caloria HT-43 selected as the hydrocarbon oil.

(HELIOSTAT, HEAT TRANSPORT)

ST77 13052 GEORGIA TECH 400 KWTH SOLAR THERMAL TEST FACILITY

Walton, J.D., Jr., Bomar, S.H., Jr., Poulos, N.E., (Georgia Inst. of Tech., Atlanta, GA), 18 p., Aug 15, 1976, Engineering Experiment Station, CONF-760842-1

Georgia Tech is constructing a 400 kWth solar test facility for high temperature solar energy research and development. Designed by Francia, it is an enlarged version of a central receiver facility developed near Genoa, Italy. The Georgia Tech facility utilizes 550 round mirrors, 111 centimeters in diameter which may be operated flat or focused to provide radiant heat fluxes from 25 to 200 W/cm² to a test area centrally located above the mirror field. Scheduled to be completed in January 1977, it will be used first to heat a boiler-superheater to deliver 365 kg/hr of steam at 150 atmospheres and 600 exp 0°C. Other uses include evaluation of experimental receivers utilizing such heat transfer fluids as steam, air, helium, oil, molten salts, and liquid metals, and basic research in the areas of metals, ceramics and coatings.

(CENTRAL RECEIVER)

ST77 13053 CENTRAL RECEIVER SOLAR THERMAL POWER SYSTEM. QUARTERLY TECHNICAL PROGRESS REPORT, APRIL 1, 1976-JUNE 30, 1976

(Boeing Engineering and Construction, Seattle, WA), 51 p., July 1976, SAN-1111-76-3

The objective of this contract is to develop a preliminary design of the collector subsystem for a 10 MW/sub e/ solar thermal power plant. Research experiments are being conducted on components, materials and large-scale hardware to support the preliminary design effort.

ST77 13054 PHILIPS STIRLING ENGINE: A STUDY OF ITS EFFICIENCY AS A FUNCTION OF OPERATING TEMPERATURES AND WORKING FLUIDS

Michels, A.P.J., (Philips Lab, Briarcliff Manor, NY), SAE Pap 769258, V 2:1306-1510, 7 refs, 1976, Publ by AIChE, New York, NY, Intersoc Energy Convers Eng Conf, 11th, Proc, State Line, NV, Sept 12-17, 1976

When solar energy is collected by flat plate or parabolic reflectors, the usable heat is in the 200°C to 500°C range. The effect of the heat source and heat sink temperatures on engine efficiency follow directly from Carnot's law. The properties of the working fluid influence the heat transfer and the flow losses in the engine. Furthermore, the operating conditions for which an engine has to be designed, especially the specific power output, also have a marked influence on engine efficiency. The inter-relationship of these various parameters studied at Philips is presented. A Philips 1-98 Stirling engine having 1 cylinder and a piston swept volume of 98 cm³ is used as the basis of the study, Philips having built about thirty engines of this type. The maximum obtainable efficiencies are determined as a function of heater temperature, using three different working fluids.

(HEAT TRANSFER, THERMAL PERFORMANCE, ANALYSIS)

14,000 THERMIONIC/THERMOELECTRIC

ST77 14005 HIGH EFFICIENCY THERMIONIC CONVERTER STUDIES

Huffman, F.N., Sommer, A.H., Balestra, C.L., Briere, D.P., Cettinger, P.E., (Thermo Electron Corp., Waltham, MA), NASA-CR-135125, 127 p., Nov 1976, TE4202-12-77, N77-13820/4WE

The objective is to improve thermionic converter performance by means of reduced inter-electrode losses, greater emitter capabilities, and lower collector work functions until the converter performance level is suitable for out-of-core space reactors and radioisotope generators. Electrode screening experiments have identified several promising collector materials. Back emission work function measurements of a ZnO collector in a thermionic diode have given values less than 1.3 eV. Diode tests were conducted over the range of temperatures of interest for space power applications. Enhanced mode converter experiments have included triodes operated in both the surface ionization and plasmatron modes. Pulsed triodes were studied as a function of pulse length, pulse potential, inert gas fill pressure, cesium pressure, spacing, emitter temperature and collector temperature. Current amplifications (i.e., mean output current/mean grid current) of several hundred were observed up to output current densities of one amp/sq cm. These data correspond to an equivalent arc drop less than 0.1 eV.

(AMPLIFICATION, PULSE TRIODES, STUDIES)

ST77 14006 ADVANCED THERMIONIC TECHNOLOGY PROGRAM PROGRESS REPORT NO. 5

(Thermo Electron Corp., Waltham, MA), 16 p., Nov 1975, TE-4202/4203-54-76

Theoretical calculations were made of the electron reflectivity for quantum mechanical models of the surface dipole layer. Research on plasma theory is summarized including the modification of the plasma program to include electron temperature gradient iteration and a series of tests using a pulsed triode converter with an electropolished arc cast tungsten emitter, a deposited tungsten oxide collector and a four wire molybdenum grid. Converter development is summarized including electrode screening for low temperature converters and evaluation of the tungsten oxide converter, titanium oxide converter, and lanthanum hexaboride converter. Also, component hardware development is summarized.

(OVERVIEW, TEST, PULSED TRIODES)

ST77 14007 ERDA/NASA ADVANCED THERMIONIC TECHNOLOGY PROGRAM, PROGRESS REPORT NO. 13

(Thermo Electron Corp., Waltham, MA), 25 p., July 1976, TE-4203/4217-11-77

Surface studies, including surface chemical analysis, work functions, Auger analysis, and ESCA analysis, of various materials for use as thermionic emitters and collectors are reported. Plasma studies are described, and hot shell development is discussed. Also, the development of alloys and alloy/coating combinations as protective cover materials for thermionic devices is outlined.

(EMITTERS, SURFACE STUDIES, MATERIALS)

15,000 OCEAN THERMAL DIFFERENTIAL

ST77 15020 TECHNICAL AND ECONOMIC EVALUATION OF OCEAN THERMAL DIFFERENCE POWER PLANT TURBO-MACHINERY - TECHNICAL REPORT, MAY 1-OCT 31, 1973

Lassard, R.D., (United Aircraft Research Labs., East Hartford, CT), NSF/RANN/SE/GI-34979/TR-73-18, NSF/RA/N-73-140, NSF GI-34979, 22 p., Prepared for Massachusetts Univ., Amherst, MA, PB-239373/4, N77-70737

Avail:NTIS

No Abstract Available

ST77 15021 ENERGY FROM THE OCEANS: REQUIREMENTS AND CAPABILITIES

Richards, A.F., (Lehigh Univ, Bethlehem, PA), Winter Annu Meet of the ASME: Ocean Resour Util, New York, NY, OED V 3:91-129, 110 refs, Dec 5-10, 1976, Publ by ASME, New York, NY, 1976

Eight methods, and a number of variants, of obtaining energy from the ocean are presented: ocean thermal, kelp bioconversion, ocean waves, tides and tidal currents, ocean winds, ocean currents, salinity gradients, and ocean geothermal. None of these methods releases "excess" heat into the environment, as do fossil-fuel and nuclear-power generating plants. The needs for seafloor engineering R&D to support all ocean energy systems center about six principal areas: mooring and anchoring systems; anchor-soil interaction; underwater electrical-transmission cable-soil interaction; in-situ soil properties and soil behavior under applied loads for continental shelf siliceous and calcareous sands, and deep-sea pelagic clays and biogenic oozes; stability-instability relationships of shelf, slope, and deep-sea floor soils; and scour and stability of structures, including large anchors and power cables, with respect to liquefaction, wave loading, and structure-soil interaction in storms. See also ST77-15017.

(OVERVIEW, BIOCONVERSION, OCEAN AT)

ST77 15022 INTERNATIONAL OCEAN DEVELOPMENT CONFERENCE, 3RD, PREPRINTS, VOLUME 1: SURVEYING AND INVESTIGATING SYSTEMS, VOLUME 2: NEW MATERIALS AND MARINE STRUCTURES, VOLUME 3: MARINE RESOURCES, VOLUME 4: MARINE POLLUTION, VOLUME 5: COAST ENVIRONMENT, AND SYMPOSIUM ON HUMAN ENVIRONMENT AND COASTAL ZONE, 1975

Anon, (Int Ocean Dev Conf), Int Ocean Dev Conf, 3rd, Prepr, Tokyo, Japan, V 5:2119, 2 Symp pts, Aug 5-8, 1975, Publ by Int Ocean Dev Conf, 1975

Avail:Secr of Int Ocean Dev Conf, Japan Manage Assoc, Tokyo

The five volumes plus a symposium volume contain 167 papers covering many different aspects of ocean development. Among the topics under which the papers are listed are submersibles, communications systems, surveying systems, materials, civil engineering and structures, mineral resources, positioning and anchoring, aquaculture, desalination, power generation, pollution, environmental protection, coastal environment, and others.

(OVERVIEW)

ST77 15023 ELECTRICITY FROM THE THERMAL POWER OF THE SEA

Winter, S.D., (Cent Natl Pour L'Exploit Des Oceans, Paris, France), Int Semin on Future Energy Prod - Heat and Mass Transfer Probl, Dubrovnik, Yugoslavia, V 2:687-699, 9 refs, Aug 25-30, 1975, Publ by Hemisphere Publ Corp, Washington, DC, 1976

Major problems associated with solar energy conversion using the thermal gradient of the sea are reviewed. Technological aspects are mentioned in connection with the choice of location of the plant and of the working medium.

(THERMAL GRADIENT)

ST77 15024 MARINE PASTURES: A BY-PRODUCT OF LARGE (100 MEGAWATT OR LARGER) FLOATING OCEAN THERMAL POWER PLANTS. PROGRESS REPORT, FEBRUARY 1, 1976-APRIL 30, 1976

Roels, O.A., (Columbia Univ., Palisades, NY), 38 p., 1976, Lamont-Doherty Geological Observatory, COO-2581-2

Computer programs have been developed to define the temperature increase which would be needed to bring deep-ocean water into density equilibrium with surface water for locations where data are available. A series of continuous-flow studies on phytoplankton blooms resulting from mixtures of 80 percent deep and 20 percent surface water in 2000-liter concrete culturing vessels ("reactors") has been completed. A quantitative determination of nutrient utilization and flow through a combined primary and secondary trophic level system has been completed. This study utilized the clam *Tapes semidecussata*, fed from phytoplankton grown in 80 percent deep and 20 percent surface water. An analysis of the fate of the deep water discharged from a floating OTEC plant indicates that horizontal containment of the resulting deep water: surface water mixture is necessary if conditions optimal for open-sea mariculture are to obtain. The design of a small open-ocean "pool" is in the final stages of completion. A combined mussel/oyster/clam system is in the final stages of design and will be placed in the ocean during April 1976.

(COMPUTER-PROGRAMS, BIOMASS)

ST77 15025 POTENTIAL MARICULTURE YIELD OF FLOATING SEA THERMAL POWER PLANTS. PART 1. GENERAL STATEMENT

Roels, O.A., Laurence, S., Van Hemelrijck, L., Amos, A.F., (City Univ., Bronx, NY, Inst. of Marine and Atmospheric Sciences), 21 p., 1975, CONF-751235-2

Mariculture is not only compatible with electrical power production in sea-thermal power plants, but it is a highly desirable and economically sensible approach to the energy and food situation currently facing the world. The technical feasibility of maintaining the proper mixing of deep and surface water, and keeping this mixed layer at an optimum depth within the euphotic zone, remains to be demonstrated, as does a simple and inexpensive means of growing and harvesting shellfish in the open sea. Increasing cooperation between the power engineers, economists, and mariculturists interested in OTEC plants is obviously needed. No sea-thermal power plant design which excludes the possibility of mariculture should be adopted until the relative contribution of the energy-production and biological potential of OTEC plants is examined carefully and in detail.

(OCEAN AT, BIOMASS)

ST77 15026 ENERGY TRANSMISSION FROM OCEAN THERMAL ENERGY CONVERSION PLANTS

Konopka, A., Talib, A., Yudow, B., Biederman, N., Winer, B., (Inst of Gas Technol, Chicago, IL), SAE Pap 769164, V 1:940-948, 26 refs, 1976, Publ by AIChE, New York, NY, Intersoc Energy Convers Eng Conf, 11th, Proc, State Line, NV, Sept 12-17, 1976, See ST77-15012

ST77 15027 GEOPHYSICAL FLUID DYNAMICS BACKGROUND FOR OCEAN THERMAL POWER PLANTS

Piasek, S.A., Juri, T., Glyn, O.R., (Naval Research Lab, Washington, DC), 69 p., Oct 1976, NRL-MR-3392, AD-A033 831/9WE

The vertical temperature gradient in the tropical oceans can be used to operate ocean thermal power plants (OTPP's) that function as heat engines. Such energy extraction would entail very large scale pumping of both warm surface water and cold bottom water through heat exchangers, with consequent disturbance and extensive mixing of surface and deep waters. The temperature difference between the warm and cold inflow water should be maximized for plant efficiency, but entrainment and recirculation between the inflow and the outflow may reduce this temperature contrast. This report provides background material and brief assessments in several areas of geophysical fluid dynamics (GFD) that bear directly on these problems. Relevant GFD research areas discussed include: turbulence and thermal wakes; ocean circulation and the permanent thermocline; air-sea interaction and thermocline variation; weather and climate modeling; and marine ecosystems. The report illustrates how each GFD area relates to specific OTPP problems, and emphasizes the multiple disciplines in GFD that must be considered.

(OCEAN AT, HEAT EXCHANGERS, THERMOCLINE)

ST77 15028 EXPERIMENTS ON CONCRETE CONICAL SHELLS FOR OTEC STRUCTURAL SYSTEMS

Mahta, H.C., Chang, T.Y., Chen, W.F., (Lehigh Univ., Bethlehem, PA, Fritz Engineering Lab), 56 p., June 1976, COO-2682-3

Tests on 13 conical concrete shells under monotonically increasing axial load conditions are described. The load-deformation response, internal stresses, and crack propagation through the elastic, inelastic, and ultimate stress ranges are presented. The properties of concrete and the behavior of the shells are varied by (1) polymer impregnation; (2) steel reinforcement as ring stiffening; and (3) general wire mesh reinforcement.

(OCEAN AT, TEST DATA)

ST77 15029 DEEP WATER PIPE, PUMP, AND MOORING STUDY: OCEAN THERMAL ENERGY CONVERSION PROGRAM. FINAL REPORT

Little, T.E., Marks, J.D., Wellman, K.H., (Westinghouse Electric Corp., Annapolis, MD, Oceanic Div.), 186 p., June 1976, COO-2642-3

The ocean engineering issues affecting the design, construction, deployment, and operation of Ocean Thermal Energy Conversion (OTEC) power plants are of key importance. This study addressed the problems associated with the conceptual design of the deep-water pipe, cold-water-pumping, and platform mooring arrangements. Analysis and evaluations are provided with a view toward judging the impact of the various subsystems on the overall plant concept and to provide an estimate of material and construction cost. Parametric data is provided that describes mooring line configurations, mooring line loads, cold water pipe configurations, and cold water pumping schemes. Selected parameters, issues, and evaluation criteria are used to judge the merits of candidate concepts over a range of OTEC plant size from 100 mWe net output power.

(OCEAN AT, ECONOMICS, POWER PLANTS, 100-1000 MWE)

ST77 15030 SOLAR SEA POWER AS A POTENTIAL ENERGY RESOURCE

Kamogawa, H., (Tokyo Shibaura Electric Co, Japan), Mar Resour, V 3:199-207, 1975, Publ by Int Ocean Dev Conf, Int Ocean Dev Conf, 3rd, Prepr, Tokyo, Japan, Aug 5-8, 1975
 Avail:Secr of Int Ocean Dev Conf, Japan Manage Assoc, Tokyo

Solar Sea Power (SSP) Generation, sometimes called Ocean Thermal Energy Conversion, which uses the temperature difference between the warm sea surface and the cold deep sea layer, may generate stable power because the sea works as a solar heat collector and solar heat storage unit simultaneously. The result of a rough analysis of the potential energy resource of the Pacific Ocean shows that SSP can be economical. It may also be considered abundant by converting the electric energy to chemical energy such as hydrogen, and transporting it to consuming markets. The elimination of harmful environmental effects should be done through careful technological assessment of the processes involved.

(OCEAN AT, ECONOMICS, CONVERSION, ENVIRONMENTAL IMPACT)

ST77 15031 PRELIMINARY RESEARCH ON OCEAN ENERGY INDUSTRIAL COMPLEXES: PHASE I

Hornburg, C.D., Lindal, B., El-Ramly, N., (DSS Engineers, Inc., Fort Lauderdale, FL), 342 p., Apr 1976, ORO-4915-3

The object of this research was to investigate the technical and economic feasibility of developing industrial complexes in conjunction with floating Ocean Thermal Energy Conversion Plants. A preliminary market analysis covering 30 possible energy intensive projects classified 12 as high demand, high growth rate. Costs of shipping bulk solids and liquids to and from the ocean site will amount to 1 to 5 percent of the product sales price. A total of 25 individual plants or processes are analyzed. The main process selected for concentration and crystallization in the sea chemicals complex was the freezing process. The main process used in the organic chemicals and plastic complex is the electric arc process. Ammonia will be produced from by-product hydrogen. Detailed capital and operating cost information is presented. It was concluded that producing energy intensive products at integrated OEICs is technically sound and economically viable.

(ECONOMICS, OCEAN AT, CONVERSION PLANT)

ST77 15032 EXTENDED NONSAP PROGRAM FOR OTEC STRUCTURAL SYSTEMS

Chang, T.Y., Chen, W.F., (Lehigh Univ., Bethlehem, PA, Fritz Engineering Lab), 56 p., Aug 1976, COO-2682-7

A constitutive relation and failure criterion for concrete material under general three-dimensional stress states has been developed using the work-hardening theory of plasticity. The formulation has all the required properties of concrete and gives a close estimate to experimental stresses for complete general stress states. In order that the results of research be readily usable in the analysis of suboceanic structures such as the large shells proposed for adoption in the Ocean Thermal Energy Conversion program (OTEC), corresponding computer codes must be developed to reflect this material. This report describes the development of the corresponding computer code in the form of a subroutine for the general purpose non-linear

finite element analysis program called NONSAP which was originally developed by the University of California at Berkeley in 1974.

(OCEAN AT, COMPUTER PROGRAM, STRUCTURES)

ST77 15033 REINFORCED CONCRETE CONSTITUTIVE RELATIONS. PROGRESS REPORT, MAY 1, 1975-FEBRUARY 29, 1976

Chen, W.F., (Lehigh Univ., Bethlehem, PA), 26 p., Mar 22, 1976, COO-2682-4

A constitutive relation and failure criterion for concrete material under general three-dimensional stress states has been developed using the work-hardening theory of plasticity. The formulation has all the required properties of concrete and gives a close estimate to experimental stresses for complete general stress states. In order that the results of research be readily usable in the analysis of suboceanic structures such as the large shells proposed for adoption in the Ocean Thermal Energy Conversion program (OTEC), corresponding computer codes have also been developed to reflect this material response. The proposed material model has been applied to several selected concrete and reinforced concrete shell structures. The finite-element subroutine for the NONSAP program has been modified and applied to analyze plain and reinforced concrete shell specimens of cone-, cylinder-, and dome-shapes under monotonically increasing axial load condition. The finite-element solid program (EPFEP) has also been developed and applied to study the behavior of concrete cylindrical hulls under hydrostatic loading conditions. The analytical results are compared with corresponding experimental data. Preliminary results indicate a close agreement to the experimental failure load.

(OCEAN AT, STRUCTURAL CRITERIA)

ST77 15034 OCEAN THERMAL ENERGY CONVERSION: RESOURCE ASSESSMENT AND ENVIRONMENTAL IMPACT FOR PROPOSED PUERTO RICO SITE

Atwood, D.K., Duncan, P., Stalcup, M.C., Barcelona, M.J., (Puerto Rico Univ., Mayaguez, Dept. of Marine Sciences), NSF/RA/N-75/347, 101 p., Dec 1975, PB-262 443/5WE, See ST77-15003

This report investigates the oceanographic conditions to be expected at the Yabucoa OTEC site, as derived from a literature survey in which the aim is to abstract the physical oceanography and meteorology facts and to set them down concisely. The literature survey reveals nothing specific to this site and the ranges around the open ocean and the south coast of Puerto Rico. The second part of the report refers to the cruise undertaken on the R/V Crawford at the site itself. The report also considers available data regarding other possible OTEC sites near Puerto Rico.

(OCEAN AT, LITERATURE SURVEY, SITING)

ST77 15035 HEAT EXCHANGERS FOR THE OCEAN THERMAL ENERGY POWER PLANT

Bell, K.J., (Oklahoma State Univ., Stillwater, OK), Int Semin on Future Energy Prod - Heat and Mass Transfer Probl, Dubrovnik, Yugoslavia, V 2:701-712, 7 refs, Aug 25-30, 1975, Publ by Hemisphere Publ Corp, Washington, DC, 1976

The two most expensive items in the Ocean Thermal Energy Concept (OTEC) are expected to be the vaporizer and the condenser for the working fluid. The principle of operation of the plant, the critical features controlling the design of the heat exchangers, the working fluids under consideration, the possible materials of construction, the biofouling problem, and some of the heat exchanger configurations are examined.

(OCEAN AT, PLANT OPERATION, WORKING FLUID)

16,000 WIND CONVERSION

ST77 16024 SANDIA VERTICAL-AXIS WIND TURBINE PROGRAM. TECHNICAL QUARTERLY REPORT, JANUARY-MARCH 1976

Weingarten, L.I., Blackwell, B.F., (Sandia Labs., Albuquerque, NM), 55 p., Aug 1976, SAND-76-0338

This quarterly report describes the activities within the Sandia Laboratories Vertical-Axis Wind Turbine Program during the third quarter of fiscal year 1976. Included are the highlights of the quarter; a review of the status of general design efforts in the areas of aerodynamics, structures, systems analysis, and testing; a summary of preliminary design details of the proposed 17-m turbine/60-kW generator system for power grid application; and structural analysis and operational test results for the existing 5-m turbine.

(60 KW, PROGRAM REVIEW)

ST77 16025 EVALUATION AND USE OF THE WIND ENERGY IN NORTH EAST BRAZIL

Albino da Souza, A., (Inst de Atividades Espaciais, Sao Jose dos Campos, Brazil), SAE Pap 769300, V 2:1741-1745, 5 refs, 1976, Publ by AICHE, New York, NY, Intersoc Energy Convers Eng Conf, 11th, Proc, State Line, NV, Sept 12-17, 1976

The first experience with a twenty to thirty kW unit for winds of seven to ten meters per second is reported. As only twenty five percent of the hydroelectricity power in Brazil is utilized planning of wind plant is to be competitive with hydro power. The structure of the wind in Brazil is analyzed and the first utilization of the prototype is shown, with the economics of its performance.

(20-30 KW, ECONOMICS)

ST77 16026 AN ESTIMATE OF THE INTERACTION OF A LIMITED ARRAY OF WINDMILLS

Crafoord, C., (Stockholm Univ., Sweden, Dept. of Meteorology), 43 p., Nov 1975, DM-16, N77-13539/OWE

Using logarithmic wind profiles, the increment of roughness parameter, as an infinite array of windmills is added to an already rough surface, is calculated by a method of superposition of surface stress and windmill drag. The obtained logarithmic profiles are used to calculate the relative power of a single windmill in an unlimited array. These values are then used as limiting values for the relative power of a windmill unit in a limited array, using a simple continuity model of energy flow. Various examples are given to illustrate the efficiency of different windmill units and array sizes. Examples are also given for a tentative 100 MW group station, using different rated power units. The results are to be seen as mainly qualitative due to the crudeness of the assumptions involved. Fairly independent of chosen rated power of the individual units, group stations with small arrays (5 to 10 rows) seem to be mainly fed by horizontal flow, but for larger array sizes exceeding 50 x 50 units, the vertical flux from above becomes more important.

(100 MW, PROTOTYPE)

ST77 16027 WIND TUNNEL MEASUREMENTS OF THE TOWER SHADOW ON MODELS OF THE ERDA/NASA 100KW WIND TURBINE TOWER

Savino, J.M., Wagner, L.B., (NASA, Lewis Research Center, Cleveland, OH), NASA-TM-X-73548, 37 p., Nov 1976, E-8984, N77-13534/LWE

Detailed wind speed profile measurements were made in the wake of 1/25 scale and 1/48 scale tower models to determine the magnitude of the speed reduction (the tower shadow). The 1/25 scale tower modeled closely the actual wind turbine including the service stairway and the equipment elevator rails on one face. The 1/48 scale model was made of all tubular members. Measurements were made on the 1/25 scale model with and without the stairway and elevator rails, and on the 1/48 all tube model without stairs and rails. The test results show that the stairs and rails were a major source of wind flow blockage. The all tubular 1/48 scale tower was found to offer less resistance to the wind than the 1/25 scale model that contained a large number of square sections. Shadow photos are included to show the extent of the blockage offered to the wind from various directions.

(ANALYTICAL DATA COMPARISON)

ST77 16028 COMPARATIVE WIND TUNNEL INVESTIGATION OF SAIL PROFILES FOR WINDMILLS

Fausl, P.L., (Technische Hogeschool, Delft, Netherlands, Dept of Aeronautical Engineering), 20 p., Feb 1975, VTH-191, N77-13012/SWE, In Dutch

Low speed wind tunnel tests were carried out to determine sail profiles for improving the performance of classical Dutch windmills. Results are presented in graphs, in which the coefficient of force-in-plane related to the wind velocity is depicted as function of the ratio between circumferential speed and effective wind velocity. It appears that improvements in performance may be obtained by changing the shape of the sails.

(GRAPHS, PERFORMANCE)

ST77 16029 NEW GENERATION SCHEME FOR LARGE WIND ENERGY CONVERSION SYSTEMS

Yadavalli, S.R., Jayadev, T.S., (Univ of Wisconsin, Milwaukee, WI), SAE Pap 769303, V 2:1761-1765, 5 refs, 1976, Publ by AICHE, New York, NY, Intersoc Energy Convers Eng Conf, 11th, Proc, State Line, NV, Sept 12-17, 1976

The scheme which utilizes the principle of an induction generator and which supplies power to the grid from both stator and rotor of an induction machine, is described in detail. Theoretical evaluation of the performance of this system is presented. A comparison is made with conventional induction generators in terms of overall efficiency and annual energy collection. Based on this study, it is concluded that the proposed generation scheme could provide an economic and efficient method to convert wind energy to electrical energy.

(INDUCTION GENERATORS, ROTORS)

ST77 16030 WIND POWERED AERATION FOR REMOTE LOCATIONS (PROGRESS REPORT, MARCH 15, 1975-MARCH 15, 1976, ERDA/NSF/-00833/.75/1)

Schierholz, P.M., Somervell W.L., Jr., Babcock, W., (Colorado State University, Department of Agricultural Engineering and Atmospheric Science), NSF/RA-760238, 66 p., Apr 1976, Colorado Division of Wildlife, AER7500833, PB-259304
No Abstract Available

ST77 16031 OPERATIONAL, COST, AND TECHNICAL STUDY OF LARGE WINDPOWER SYSTEMS INTEGRATED WITH EXISTING ELECTRIC UTILITY

Smith, P.T., Swanson, R.K., Johnson, C.C., Ligon, C., Lawrence, J., Jordan, D., (Southwest Res Inst, San Antonio, TX), SAE Pap 769302, V 2:1754-1760, 1976, Publ by AICHE, New York, NY, Intersoc Energy Convers Eng Conf, 11th, Proc, State Line, NV, Sept 12-17, 1976
See ST77-16016

ST77 16032 STOCHASTIC MODELING OF SITE WIND CHARACTERISTICS

Ross, B.C., (Northwestern Univ., Evanston, IL, Dept. of Civil Engineering), ERDA/NSF-00357/76/1, 311 p., Nov 1976, PB-261 178/8WE
The economic feasibility of a wind energy conversion system depends on an accurate assessment of the wind characteristics at each site. Statistical methods and probability models are used to determine optimal evaluation procedures for survey data. Several years of hourly records from six Midwest sites and one Rocky Mountain site provide a data base to develop the models and procedures.

(ECONOMICS)

ST77 16033 GEOTHERMAL ENERGY AND WIND POWER - ALTERNATE ENERGY SOURCES FOR ALASKA. PROCEEDINGS OF ALASKAN GEOTHERMAL AND WIND POWER RESOURCES PLANNING CONFERENCE HELD AT ANCHORAGE, ALASKA ON JULY 8-9, 1975

Forbes, R.B., (Alaska Univ., College, Geophysical Inst.), NSF/RA-760246, 256 p., Apr 1976, PB-261 521/9WE

This report defines the Alaskan energy problems that can be alleviated through wind and geothermal resources, and presents recommended plans for the initiation of state and federal programs. Working groups were formed in the following areas: agriculture, electrical power, fisheries and agriculture, geothermal resource research and development, space heating and industrial application, and wind power development and applications.

(OVERVIEW)

ST77 16034 MATHEMATICAL MODELING OF TOPOGRAPHIC EFFECTS OF WIND ENERGY SYSTEMS

Freeman, B.E., Taft, J.R., (Battelle Pacific Northwest Labs., Richland, WA), 26 p., Apr 1976, Microfiche copies only, CONF-760909-3, BNWL-SA-5935

In the basic wind characteristics assessment procedure a new step is incorporated to overcome its most serious deficiencies. This step employs mathematical model-based meteorological prediction tools. With them climatological data from weather stations in the region are used to infer climatological data at the unmeasured locations within the region. Meteorological phenomena taking place in regions comparable to the distance between synoptic weather stations (approximately 200 km) and in the immediate vicinity of the windmill site (approximately 1 km) are considered. Computer codes were developed for each of these regimes, and calculations of wind flow over complex terrain have been performed. Results of some of these wind calculations are presented, illustrating the effects of terrain on wind energy potential.

(COMPUTER ANALYSIS)

ST77 16035 FREE ENERGY - AT A COST: ELECTRICITY BY WIND ENERGY CONVERSION

Anon, Int Constr, V 15:40-41, 43, 45, 47-48, N11, Nov 1976

The article presents a review on the developments and current status of utilization of wind power in electric energy production and conversion.

(OVERVIEW)

ST77 16036 EARLY OPERATION EXPERIENCE ON THE ERDA/NASA 100 KW WIND TURBINE

Glasgow, J.C., Linscott, B.S., (NASA, Lewis Research Center, Cleveland, OH), NASA-TM-X-71601, 25 p., Sept 1976, E-8076, N77-10640/9WE

As part of the Energy Research and Development Administration (ERDA) wind energy program, NASA Lewis Research Center is testing an experimental 100-kW wind turbine. Rotor blade and drive shaft loads and tower deflection were measured during operation of the wind turbine at rated rpm. The blade loads measured are higher than anticipated. Preliminary results indicate that air flow blockage by the tower structure probably caused the high rotor blade bending moments.

(TESTS, ROTOR BLADES)

ST77 16037 COMPARISON OF DIFFERENT WIND ENERGY CONVERSION SYSTEMS. PART I. THE NOAH SYSTEM COMPARED WITH THE ULRICH HUTTER SYSTEM.

10 p., 1976, Translation of German report. RFP-Trans-204

The analysis is being made within the framework of structural components which are generally important for wind energy systems. Advantages and disadvantages are evaluated from technical viewpoints (type of construction, novelty, susceptibility to failure, ease of repairs, maintenance requirements), as well as in terms of expected power, performance, manufacturing cost and economy.

ST77 16038 WIND POWER STUDIES: FIELD MEASUREMENT PRIORITIES FOR NUMERICAL ANALYSIS OF WIND ENERGY. PROGRESS REPORT, APRIL-JUNE 1976

Hardy, D.M., (California Univ., Livermore, Lawrence Livermore Lab), 17 p., June 15, 1976, UCRL-30034-76-3

Results of initial numerical studies and their role in planning the July-August 1976 field program are presented. The acquisition, calibration, and deployment of meteorological instruments for the field program are reviewed.

ST77 16039 FLYING IN THE FACE OF THE WIND

Anon, Consult Eng, London, V 40:42-43, N11, Nov 1976

The practical approach, building a windmill in Denmark is discussed together with a project - to build a 54 m diam, 2 MW windmill, which will generate all the community's electricity and have spare capacity to feed the national grid.

(DENMARK, 2MW)

ST77 16040 PROCEEDINGS OF THE VERTICAL-AXIS WIND TURBINE TECHNOLOGY WORKSHOP, ALBUQUERQUE, NEW MEXICO, MAY 18-20, 1976

(Sandia Labs., Albuquerque, NM), 517 p., July 1976, CONF-760551, SAND-76-5586

Separate abstracts are included for twenty-nine of the thirty papers presented concerning vertical axis wind turbines. One paper has previously been abstracted and included in the ERDA Energy Data Base and Energy Research Abstracts journal.

ST77 16041 CONSUMER'S COST OF ELECTRICITY FROM WINDMILLS

Quinn, B., (Air Force Off of Sci Res, Bolling AFB, Washington, DC), SAE Pap 769301, V 2:1746-1753, 8 refs, 1976, Publ by AICHE, New York, NY, Intersoc Energy Convers Eng Conf, Lith, Proc, State Line, NV, Sept 12-17, 1976

The analysis considers typical American consumption patterns and ties them to the annual variation of the supply of wind energy. This identifies a critical period, when the consumer's demand most strains the available energy. A windmill system is then sized in terms of demand and under the constraints of the critical period. Manufacturers and suppliers of components are surveyed for costs and the data are used to arrive at the capital required to satisfy demand. Amortization determines the unit cost of electricity, around 22 cents per KWH for a 99 percent probability of an average standard of living. Discussion of special cases for which unit costs could be substantially lower is presented.

(ECONOMICS, COMPONENTS)

ST77 16042 WIND-POWER GENERATION ON A LARGE SCALE. A DESIGN IDEA

Mensforth, T., (John Brown & Co), Electron Power, V 22:530-532, N8, Aug 1976

Windmills are today the subject of some intensive research to provide an alternative source of power. In this article, a retired engineer recalls the Orkney windmill project circa 1950 with which the engineer was closely associated, and outlines the design of a 10 MW windmill generator.

(ALTERNATE SOURCE, 10MW)

ST77 16043 WIND POWER PREDICTION MODELS

Levy, R., McGinness, H., (JPL, California Inst. of Tech., Pasadena, CA), NASA-CR-149235, 61 p., Nov 15, 1976, Telecommunications Div., JPL-TM-33-302, N77-12509/4WE

Investigations were performed to predict the power available from the wind at the Goldstone, California, antenna site complex. The background for power prediction was derived from a statistical evaluation of available wind speed data records at this location and at nearby locations similarly situated within the Mojave desert. In addition to a model for power prediction over relatively long periods of time, an interim simulation model that produces sample wind speeds at hourly intervals that reproduces the statistical wind distribution at Goldstone. A stochastic simulation model to provide speed samples representative of both the statistical speed distributions and correlations is also discussed.

(SYSTEM ANALYSIS)

ST77 16044 INTERNATIONAL SYMPOSIUM ON WIND ENERGY SYSTEMS, HELD AT CAMBRIDGE UNIV., SEPT 7-9, 1976

Nunn, R.H., (Office of Naval Research London, England), 28 p., Dec 7, 1976, ONRL-C-31-76, AD-A034 871/4WE

Vertical - and horizontal-axis systems were discussed both in theory and in practice. Applications ranged from wind forms each with hundreds of megawatt units to the use of Cretan windmills to provide water for cattle. Wind energy conversion units have been operated in several configurations and the theory of their performances is sufficiently advanced to allow design for fabrication. The trends are towards larger units for municipal power systems and smaller units for domestic use. In the former case, the behavior of large wind turbines operating in large arrays, and the output (with and without storage of several such arrays when geographically dispersed, has yet to be well understood. The field has reached a level of maturity characterized by such factors as economics, environmental impact, and public acceptance.

(OVERVIEW, VERTICAL-AXIS, HORIZONTAL-AXIS)

ST77 16045 BARRIERS TO THE USE OF WIND ENERGY MACHINES: THE PRESENT LEGAL/REGULATORY REGIME AND A PRELIMINARY ASSESSMENT OF SOME LEGAL/POLITICAL/SOCIETAL PROBLEMS

Taubenfeld, R.F., Taubenfeld, H.J., (Societal Analytics Inst., Inc., Dallas, TX), NSF/RA-760422, 159 p., July 1976, PB-263 576/1WE

This report analyzes and assesses the present state of law and regulation at all levels of government that may affect wind energy machines. Also analyzed and assessed is the state of analogous and related law and regulation, requirements at various levels of government, and international rules, as wind machines grow larger and/or are used in arrays. It suggests some potential impacts of the development of wind-based power technology on selected aspects of the American economy, particularly on the energy delivering utilities.

(OVERVIEW, SOCIOECONOMIC IMPACT)

ST77 16046 PREDICTING WIND POWER AT TURBINE LEVEL FROM AN ANEMOMETER RECORD AT ARBITRARY HEIGHT

Reed, J.W., (Sandia Labs., Albuquerque, NM), 10 p., 1976, CONF-760909-1, SAND-76-5397

Wind speed variation with height in the frictional boundary layer depends on wind speed, surface roughness and thermodynamic stability. Over relatively flat terrain, suitable for extensive fields of wind energy extractors, useful wind increases in proportion to the one-seventh power of height above ground. This closely approximates the more general and theoretically based logarithmic model above standard 10 meter anemometer height and with the 0.03m roughness length often found by observation. Several data collections have been assembled to verify the utility of this one-seventh power law, from special meteorological research towers as well as long-term records from regular weather stations where the anemometer happened to be moved on occasion. A minor correction for lower speeds of 2-8m/s improves predictions but is not essential to gross power availability calculations for large turbine blades.

(LOGARITHMIC MODEL)

17,000 BIOCONVERSION

ST77 17017 COVERED ENERGY FARMS FOR SOLAR ENERGY CONVERSION

Bassham, J.A., (California Univ., Berkeley, Lawrence Berkeley Lab.), 20 p., Apr 1976, CONF-760354-1, LBL-4844

The reasons for the low efficiency of solar energy conversion in plants are described in order to clarify the economic factors affecting the development of biomass on energy plantations. A proposal is made for an energy plantation in the desert covered with inflatable plastics to prevent water loss. The crop suggested is alfalfa as it can be harvested ten or twelve times a year and a very high nutritional value protein can be extracted from the leaves by pressing. The residue would be burned to generate electricity. The combined profits from the sale of protein and from the sale of electricity might make this concept economically feasible in a society with expensive energy and food.

(BIOCONVERSION, ECONOMICS)

ST77 17018 BIOLOGICAL SOLAR ENERGY CONVERSION - APPROACHES TO OVERCOME YIELD, STABILITY AND PRODUCT LIMITATIONS - PROGRESS REPORT, OCT 1, 1975-MAR 31, 1976

Kok, B., Fowler, C.F., Hardt, H.H., Radmer, R.J., (Martin Marietta Labs., Baltimore, MD), NSF/RA-760055 PR-2, NSF AER73-03291, NSF PCM74-20736, 81 p., MML-TR-76-16C, E(11-1)-3326, PB-258850, N77-73777
 Avail:NTIS

No Abstract Available

ST77 17019 MULTIDISCIPLINARY RESEARCH PROGRAM DIRECTED TOWARD UTILIZATION OF SOLAR ENERGY THROUGH BIOCONVERSION OF RENEWABLE RESOURCES PROGRESS REPORT

Finnerty, W.R., (Georgia Univ., Athens, GA), 73 p., SRO-888-1, E(38-1)-888, N77-75759
 Avail:NTIS
 See ST77-17004

ST77 17020 SOLAR SNG: LARGE-SCALE PRODUCTION OF SNG BY ANAEROBIC DIGESTION OF SPECIALLY GROWN PLANT MATTER

Fraser, M.D., (InterTechnol Corp, Warrenton, VA), SAE Pap 769016, V 1:83-90, 13 refs, 1976, Publ by AIChE, New York, NY, Intersoc Energy Convers Eng Conf, 11th, Proc, State Line, NV, Sept 12-17, 1975

An Energy Plantation is a means for producing fuels by collecting and storing solar radiation in plants grown purposely for their fuel value. The plant material can be converted into synthetic natural gas (SNG) by anaerobic digestion. Suitable raw material for SNG production is sapwood from certain fast-growing deciduous species, and warm-season grasses. Some sort of pretreatment is necessary to make the plant material digestible, and extensive grinding combined with steeping in hot water has been selected as the most practical and economic pretreatment. A concept of a feasible SNG-producing process has been developed and is described. It is estimated that about 4.5 standard cubic feet (SCF) of methane can be produced per dry pound of deciduous plant material ($0.281 \text{ m}^3/\text{kg}$) at a cost of between \$3.75 and \$5.00 per thousand SCF (\$132 to \$177 per thousand m^3), depending upon the values of certain influential process parameters. The capital cost of the SNG plant is estimated to be between \$2.00 and \$3.00 per daily SCF (\$71 to \$106 per daily m^3) of capacity.

(ECONOMICS, BIOCONVERSION, METHANE)

ST77 17021 EVALUATION OF THE USE OF AGRICULTURAL RESIDUES AS AN ENERGY FEEDSTOCK, VOLUME I STANFORD RESEARCH INSTITUTE PROJECT 3520, NSF/RANN/SE/GI18615/FR/76/3)

(Stanford Research Institute), NSF/RA-760286, 174 p., July 1976, AER7418615A03, GI18615, PB-260763

No Abstract Available

ST77 17022 EVALUATION OF THE USE OF AGRICULTURAL RESIDUES AS AN ENERGY FEEDSTOCK, VOLUME II, (STANFORD RESEARCH INSTITUTE PROJECT 3520, NSF/RANN/SE/GI18615/FR/76/3)

(Stanford Research Institute), NSF/RA-760287, 608 p., July 1976, AER7418615A03, GI18615, PB-260764

No Abstract Available

ST77 17023 ENERGY FROM AGRICULTURE - THE MOST ECONOMIC METHOD OF LARGE SCALE SOLAR ENERGY CONVERSION

Alich, J.A., Jr., Inman, R.E., (Stanford Res Inst, Menlo Park, CA), Energy, Oxford, V 1:53-61, N1, May 1976, See ST77-17000

The economics of terrestrial growth of vegetation for its energy content is far more favorable than other more technically sophisticated methods of large-scale solar energy conversion - mirrors, photovoltaics, etc. This paper summarizes the authors' view of what might be attainable in biomass production, hoping, thereby, to stimulate interest in the concept. The type of vegetation best suited for an intensive energy plantation, as well as vegetation selection criteria, are discussed. The type and availability of land for growing energy crops on a conceptual terrestrial plantation, as well as the logistics and economics, are discussed. An energy budget for plant-material production and harvesting for the conceptual plantation is developed. A technoeconomic comparison of firing the crops directly for electric power generation with conversion to clean fuel gas (methane or low-Btu gas) either at the farm site or at selected markets is made.

18,000 RESIDENTIAL

ST77 18008 INTEGRATION OF PHOTOVOLTAIC AND SOLAR-THERMAL ENERGY CONVERSION SYSTEMS

Schueler, D.G., Fossum, J.G., Burgess, E.L., Vook, F.L., (Sandia Lab, Albuquerque, NM), Conf Rec of the IEEE Photovoltaic Spec Conf, 11th, Scottsdale, AZ, p. 327-331, May 6-8, 1975, Publ by IEEE, New York, NY, 1975, Cat N75CH0948-OED

This paper examines ways of reducing the effective cost of terrestrial photovoltaic conversion systems using single crystal silicon cells by taking advantage of their ability to operate efficiently at high illumination levels, and by combining photovoltaic and solar-thermal conversion processes in an integrated solar collector. A semiconductor device simulation computer code has been used to optimize the design of silicon solar cells operating in multi-sun, elevated temperature environments. The results of these calculations, along with evaluation of the performance of prototype cells, indicate that silicon cells with modified metallization and doping levels can achieve 12% conversion efficiency when operated at 40 suns terrestrial illumination and 100°C junction temperature.

(ECONOMICS, RADIATION, COMPUTER CODE)

19,000 OTHER - HYDROGEN PRODUCTION, LARGE SCALE PHOTOVOLTAIC, ETC.

ST77 19011 STUDY OF AN UNDERWATER POWER UNIT USING ALUMINUM METAL AS FUEL

Kaiho, Y., (UMI Co, Tokyo, Japan), New Mater and Mar Struct, V 2:117-126, 1975, Publ by Int Ocean Dev Conf, Int Ocean Dev Conf, 3rd, Prepr, Tokyo, Japan, Aug 5-8, 1975
 Avail: Secr of Int Ocean Dev Conf, Japan Manage Assoc, Tokyo, Japan

It is well known that alkali metals such as sodium at normal temperature, or other metals such as aluminum, magnesium and zinc in the molten state will, when in contact with water, react violently and generate a great deal of heat. The application of this reaction for energy generation is atmosphere independent and therefore, suited for underwater use. Also such metals as aluminum are commercially available and useable as fuel. In applying the principle, there still remain many critical problems in feed of fuel, power control including starting and re-starting of the engine, and heat-resisting devices and materials. The paper reports on research into solving some of these problems, using the test model "U-4B" designed and developed for general purposes under submerged conditions.

(POWER GENERATION, ALUMINUM ALLOYS, THERMAL ENERGY)

ST77 19012 POSSIBILITY OF LARGE ELECTRIC OUTPUT BY FLOATING TYPE SEA WAVE ELECTRIC GENERATOR

Masuda, Y., Miyazaki, T., Emura, T., (Japan Mar Sci & Technol Cent, Yokosuka, Japan), Mar Resour, V 3:219-228, 1975, Publ by Int Ocean Dev Conf, Int Ocean Dev Conf, 3rd, Prepr, Tokyo, Japan, Aug 5-8, 1975
 Avail: Secr of Int Ocean Dev Conf, Japan Manage Assoc, Tokyo, Japan

The paper reports on a laboratory study of electrical output from a large, floating Sea Wave Electric Generator (SWEG). Such units convert sea wave power into electric power, and small units are already in use powering buoys and lighthouses in Japan. Based on the study tests, it is concluded that most of the sea wave energy can be absorbed, and it will be possible to make large SWEG units.

(ELECTRIC POWER, GENERATION, ENERGY RESOURCES)

ST77 19013 OCEAN FOOD AND ENERGY FARM PROJECT

Wilcox, H.A., (Nav Undersea Cent, San Diego, CA), Mar Resour, V 3:43-52, 38 refs, 1975, Publ by Int Ocean Dev Conf, Int Ocean Dev Conf, 3rd, Prepr, Tokyo, Japan, Aug 5-8, 1975
 Avail: Secr of Int Ocean Dev Conf, Japan Manage Assoc, Tokyo, Japan

The Project is designed to explore and develop the ability to raise the giant California kelp and/or other seaweeds, plants, and marine animals in the tropical and temperate oceans. Sponsored by the National Science Foundation and other agencies of the U.S. Government and private industry, the project is a three-phase, 11 to 15 yr effort to result in a 40,000 hectare farm system in the Atlantic or Pacific by the 1985 to 1990 time period. This system is projected to produce foods, fuels, fertilizers, plastics, and other products for man's consumption at a rate sufficient to supply all the requirements for 12 to 20 persons per hectare of cultivated ocean. The productivity of the system is based on bringing the nutrients of the deep waters by means of wave-powered upwelling devices into contact with the solar energy of the surface waters.

(BIOLOGICAL PRODUCTIVITY, MARINE ORGANISMS, HYDRODYNAMICS)

ST77 19014 TIDAL ENERGY - A WORLD QUESTION WITH LIMITED ANSWERS

Anon, Int Constr, V 15:50-56, N11, Nov 1976

The article presents a review on the developments and current status of utilization of tidal power in electric energy production and conversion.

(OVERVIEW, POWER GENERATION, HYDRODYNAMICS)

ST77 19015 NEAR-UV PHOTON EFFICIENCY IN A TiO//2 ELECTRODE: APPLICATION TO HYDROGEN PRODUCTION FROM SOLAR ENERGY

Desplat, J.L., (Cent d'Etud Nucl de Saclay, Gif-sur-Yvette, France), J Appl Phys, V 47:5102-5104, N11, 8 refs, Nov 1976

An n-type (001) TiO//2 electrode irradiated at 365 nm was tested under anodic polarization: a saturation current independent of pH and proportional to light intensity has been observed. Accurate measurements of the incident power lead to a 60% photon efficiency. A photoelectrochemical cell built with such an electrode, operated under solar irradiation without concentration, produced an electrolysis current of 0.7 mA cm⁻² without applied voltage.

(PHOTOVOLTAICS, ELECTRO CHEMICAL CELLS)

ST77 19016 HYDROGEN FROM SOLAR ENERGY VIA ENERGY ELECTROLYSIS

Cox, K.E., (Univ of New Mexico, Albuquerque, NM), SAE Pap 769162, V 1:926-932, 13 refs, 1976, Publ by AIChE, New York, NY, Intersoc Energy Convers Eng Conf, 11th, Proc, State Line, NV, Sept 12-17, 1976.

A simple method to produce hydrogen is by the electrolysis of water. Power for the electrolysis cells is supplied by an array of silicon solar photovoltaic cells. Experiments are conducted with a 12 watt (peak power) array wired directly to an electrolyzer. Initial results, though not optimum, show that hydrogen is produced at efficiencies of up to 102. An average efficiency of 4.3% is obtained in daily tests.

(PHOTOVOLTAICS, EXPERIMENTAL, TESTING)

ST77 19017 ENERGY CONVERSION VIA PHOTOELECTROLYSIS

Nozik, A.J., (Allied Chem Corp, Morristown, NJ), SAE Pap 769009, V 1:43-50, 26 refs, 1976, Publ by AIChE, New York, NY, Intersoc Energy Convers Eng Conf, 11th, Proc, State Line, NV, Sept 12-17, 1976.

Photoelectrolysis is a new energy conversion scheme in which optical energy is converted into chemical energy using photoactive semiconducting electrodes in a photoelectrochemical cell. The process is shown to involve multiphoton effects so that use can be made of visible light. A model for photoelectrolysis is presented which encompasses the mechanism and the energetics of the process. Application of photoelectrolysis to the generation of hydrogen from water using solar radiation is discussed. Data on energy conversion efficiencies are presented for several semiconductor electrode systems. These semiconductors have been studied in the form of single crystals and polycrystalline thin films. The economic viability of photoelectrolysis as a potential scheme for the generation of hydrogen is discussed and comparisons are made with conventional hydrogen generating processes.

(SEMICONDUCTORS, PHOTOVOLTAICS, SOLAR CELLS)

ST77 19018 PHOTOASSISTED ELECTROLYSIS OF WATER: CONVERSION OF OPTICAL TO CHEMICAL ENERGY

Wrighton, M.S., Bolts, J.M., Ellis, A.B., Kaiser, S.W., (MIT, Cambridge, MA), SAE Pap 769008, V 1:35-42, 42 refs, 1976, Publ by AIChE, New York, NY, Intersoc Energy Convers Eng Conf, 11th, Proc, State Line, NV, Sept 12-17, 1976.

Photoelectrochemical cells for the photoelectrolysis of H_2O to H_2 and O_2 are described. Such cells can, in principle, be used to efficiently convert solar energy to chemical energy in the form of the electrolysis products. The basic principles, potential advantages, and current problems associated with photoelectrochemical cells as energy conversion devices are outlined. The current state of the research in this area is briefly reviewed, and work carried out in the authors' laboratory on TiO_2 -, SnO_2 -, $SrTiO_3$ -, $KTaO_3$ -, and KTa_2O_7 -based cells is highlighted. For the perovskite based cells the highest efficiencies obtain, and conversion of solar to chemical energy for $SrTiO_3$ has been observed to be as efficient as about 1%. However, all of the metal oxide photoelectrodes listed above respond only to ultraviolet light which is a small fraction of the solar spectrum. Approaches to developing visible light responding cells are discussed.

(OVERVIEW, PHOTOVOLTAICS, ELECTROCHEMICAL CELLS, SOLAR CELLS)

ST77 19019 PHOTOVOLTAIC ENERGY CONVERSION USING CONCENTRATED SUNLIGHT

Burgess, E.L., (Sandia Labs., Albuquerque, NM), 7 p., Presented at 20th Ann. SPIE Technical Symp., San Diego, CA, Aug 23, 1976, SAND-76-5759, CONF-760832-3, E(29-1)-789, N77-19647 Avail:NTIS

A development program is described which uses sunlight concentration techniques to effect an immediate reduction in cost-per-unit-power for photovoltaic systems in which solar cell cost dominates the total system cost. Current examples of concentrator solar cell technologies are single crystal silicon and gallium arsenide. Implementation of cost reductions by the use of sunlight concentration is not dependent on the development of low-cost, mass-production cell technologies but emphasizes high cell efficiency and low-cost concentrator systems.

(ECONOMICS, PRODUCT DEVELOPMENT)

ST77 19020 TECHNICAL DESIGN AND ECONOMIC VIABILITY OF LARGE-SCALE SOLAR-CELL/HYDROGEN-FUEL ENERGY SYSTEMS A RESEARCH PROPOSAL

Greeley, R.S., (METRE Corp., McLean, VA), 120 p., Sponsored by NSF, M72-139, N77-70488 No Abstract Available

ST77 19021 SOLAR ENERGY CONVERSION OF WATER TO HYDROGEN

Anon, (Univ of North Carolina, Greensboro, NC), Platinum Met Rev, V 20:123, N4, Oct 1976

A potentially most important discovery of a means of producing hydrogen from water by photochemical cleavage has been announced by a team led by Professor David G. Whitten of the Department of Chemistry in the University of North Carolina. The reaction, which could have a major impact on future energy requirements, involves a ruthenium complex, tris(2, 2' -bi-pyridine)ruthenium (II)²⁺. Professor Whitten and his colleagues have found (Gerhard Sprintschnik, Hertha Sprintschnik, Pierre Kirsch and David Whitten, J. Am. Chem. Soc., 1976, 98, (8), 2337-2338) that by reacting this compound with dioctadecyl or dihydrocholesteryl esters to yield long-tailed surfactant complexes insoluble in water, these can effectively promote cleavage. Spread as a monolayer on sheets of glass, in contact with water and irradiated by light, these complexes give rise to a steady stream of molecular hydrogen and oxygen.

(PHOTOCHEMICAL REACTION)

ST77 19022 DESIGN CONSIDERATIONS FOR HIGH-INTENSITY SOLAR CELLS

Dalal, V.K., Moore, A.R., (RCA Laboratories, Princeton, NJ), Journal of Applied Physics, V 48:1244-1251, Mar 1977, A77-25591

Factors affecting the efficiency of Si and GaAs solar cells in the presence of high-intensity sunlight are examined. The theory of efficient solar-cell design is briefly reviewed, focusing on short-circuit current, open-circuit voltage, fill factor, and efficiency degradation. Effects of high intensity on collection efficiency and parasitic losses are investigated. It is shown that the current-collection efficiency of Si cells increases at intermediate levels but may be reduced at very high intensities due to plasma recombination, that open-circuit voltage and fill factor increase with intensity at a faster rate in Si than in GaAs, and that an increase in temperature degrades the efficiency of Si faster than that of GaAs. Appropriate heat-sink designs to minimize such thermal degradation are considered along with the choice of materials and tracking systems for high-intensity solar cells. It is concluded that there is no significant advantage in choosing GaAs over Si and that temperature rises can be kept as low as 25°C by simple heat-sink designs.

(PHOTOVOLTAIC CONVERSION, THERMAL DEGRADATION)

ST77 19023 THE ADVANTAGES OF SUN TRACKING FOR PLANAR SILICON SOLAR CELLS

Mosher, D.M., Boese, R.E., Soukup, R.J., (Iowa University, Iowa City, IA), Solar Energy, V 19: 91-97, N1, 1977, A77-25904

The paper discusses four factors critically important in comparing the output of a tracking solar cell with that of a stationary cell. These factors are the variation of solar intensity on horizontal surfaces due to the spreading of light, the variation of light transmission through the air-solar cell interface at different incident angles, the variation in photon path length near the P-N junction with incident solar angle, and the variation in transmission of solar energy by the atmosphere as a function of time of day. It is shown that as long as the operation of the tracker can be devised to consume a minute fraction of the output gain realized, sun tracking using planar solar cells is preferable to stationary mounted solar cells.

(COMPARISON, SYSTEMS ENGINEERING, DIURNAL VARIATIONS)

ST77 19024 HETEROGENEOUS SENSITIZED DECOMPOSITION OF WATER WITH SUNLIGHT QUARTERLY PROGRESS REPORT, JAN 1-MAR 31, 1976

Ghosh, A.K., Maruska, H.P., (Exxon Research and Engineering Co., Linden, NJ, Government Research Lab.), NSF/RA-760104, NSF ERP-75-13901, 40 p., EXXON/GRU.3BEA.76, PB-254486/4, N77-73525

Avail:NTIS HC A03/MF A01
No Abstract Available

ST77 19025 PROPOSAL ON THE GENERATING SYSTEM OF LARGE ELECTRIC POWER FROM SEA WAVE

Kobayashi, H., (Nihon Univ, Fukushima, Japan), Mar Resour, V 3:209-218, 1975, Publ by Int Ocean Dev Conf, Int Ocean Dev Conf, 3rd, Prepr, Tokyo, Japan, Aug 5-8, 1975

Avail:Secr of Int Ocean Dev Conf, Japan Manage Assoc, Tokyo

A system is proposed for harnessing the horizontal motion of sea waves for generating electricity. The system is based on hollow vanes attached to a rotating track, through which the horizontal motion picked up by the vanes is transferred to a generator. The vanes rotate only at fixed angles with respect to the track when intercepting the horizontal motion of the waves, and they retract parallel to the track axis on the downstroke to reduce drag. The entire system floats just below the water surface.

(ENERGY RESOURCES, POWER GENERATION)

ST77 19026 POWER EXTRACTION FROM WATER WAVES

Chiang, C.M., (MIT, Cambridge, Ralph M Parsons Lab for Water Resources and Hydrodynamics, MA) 5 p., Aug 9, 1975, AD-A032 781/7WE
 Avail:Pub. in Jnl. of Ship Research, V 20:63-66, N2, June 1976

Salter has demonstrated experimentally that a horizontal cylinder in the free surface of water can be a device to extract energy from the incident waves. This paper proposes a design which is based on the idea of a tethered-float breakwater, and gives the theoretical design criteria for maximum power extraction from a general floating cylinder with one or two degrees of freedom. It is shown that the rate of energy extraction must be equal to the rate of radiation damping and that the floating body must be made to resonate. Then for a body with one degree of freedom, the maximum efficiency at a given frequency can be a least one half if the body is symmetrical about a vertical axis, and greater for an asymmetrical body. For a body with two degrees of freedom, all the wave power can be extracted. Hydrodynamical aspects of the controlled motion are examined. Viscous effects are ignored.

(POWER GENERATION, HYDRODYNAMICS, PROPOSAL)

ST77 19027 ANALYSIS OF THE SUN PUMPED LASER CONE OPTICS

Perry, M.T., (Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering), 60 p., Sept 1976, GEP/PH/76-11, AD-A034 284/OWE

A meridional ray analysis is accomplished on the solar energy collector part of a sun pumped laser. A Gaussian approximation is completed and shows a solar image 0.57 inches in diameter is located 3.81 cm from the end of the laser rod. The image is inside the laser cavity. For 200 watts available at the primary mirror of the Cassegrainian System, it is found that only about 150 watts is furnished to the cone lens for through put. Only about 66% of the available 150 watts is collected by the cone lens and channelled to the laser rod by the condensing cone. The last is found by a skew ray analysis of some rays coming from the outer radial part of the primary mirror. These rays are traversing the system all the way to the cone lens, but are diverging before entering the lens and therefore not being collected by the condenser cone. An analysis is made of the exit angle of the power traversing the condenser cone. The analysis was made so that an AR coating of the appropriate material and thickness could be put on the laser rod for maximum collection of the solar energy wavelengths used in pumping the Nd:YAG laser rod.

(MATHEMATICAL MODEL, OPTICAL COLLECTORS, OVERVIEW)

ST77 19028 NEW TYPE OF WAVE-ACTIVATED GENERATOR LIGHTED BUOY

Akane, T., Izumi, H., (Ryokuseisha Corp, Tokyo, Japan), Mar Resour, V 3:229-247, 1975, Publ by Int Ocean Dev Conf, Int Ocean Dev Conf, 3rd, Prepr, Tokyo, Japan, Aug 5-8, 1975
 Avail:Sect of Int Ocean Dev Conf, Japan Manage Assoc, Tokyo, Japan

About 10 years have passed since the first TG-1 Wave-Activated Generator was put on the market. Since then there has been a demand for a more compact, lighter and lower-priced generator model. To meet these requirements, the TG-2 and TG-101 Wave-Activated Generators were recently developed. The paper describes the results of experiments and gives an example of estimation to obtain required power from these wave-activated generators.

(POWER GENERATION, OPTICAL MARKERS, TESTING)

ST77 19029 ELECTRO-OPTICAL SYSTEMS DESIGN CONFERENCE/INTERNATIONAL LASER EXPOSITION, PROCEEDINGS OF THE TECHNICAL PROGRAM, 1975

Anon, (Ind and Sci Conf Manage, Inc, Chicago, IL), Electro-Opt Syst Des Conf/Int Laser Expo, Proc of the Tech Program, Anaheim, CA, 845 p., Nov 11-13, 1975, Publ by Ind and Sci Conf Manage, Inc, Chicago, IL, 1975

One hundred and twenty seven papers were presented at the Conference held in Anaheim, California in November, 1975. Topics included: optical computing, wideband laser recording, optics in solar energy, and laser isotope separation.

(OVERVIEW, OPTICAL INSTRUMENTS, PROCESSING)

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